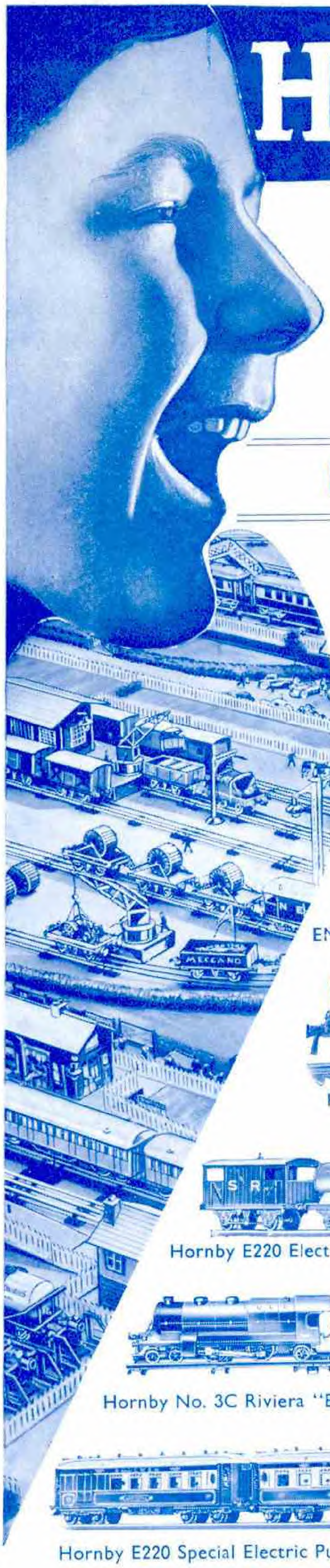
VOL XXI. Nº 7.

JULY 1936.

# MECCANO MAGAZINE



6D.



# HORNBY TRAINS

BRITISH AND GUARANTEED

## Real and Lasting Fun

The splendid fun of running a Hornby Railway is real and lasting, because of the exceptional strength and reliability of Hornby Locomotives, both Electric and Clockwork, the realistic appearance and easy running of the Rolling Stock, and the wide range of effective Accessories.

From the day of their introduction Hornby Trains have always represented the latest model railway practice. Designs are continually being improved and new items added so that the system is complete in practically every detail.

Ask your dealer for a copy of the latest Hornby Train price list.

PRODUCT of MECCANO LIMITED LIVERPOOL

## Boys! Run your own model railway

### A SELECTION FROM THE RANGE OF HORNBY ELECTRIC and CLOCKWORK TRAINS



M1 Clockwork Passenger Train Set (reversing). Price **8/11**



EM320 (20-volt) or EM36 (6-volt) Electric Tank Goods Train Set (reversing). Price **24**/-



Hornby No. 1 Clockwork Passenger Train Set (reversing). Price **25**/-



Hornby E220 Electric Mixed Goods Train Set (20-volt, automatic reversing). Price **47/6**

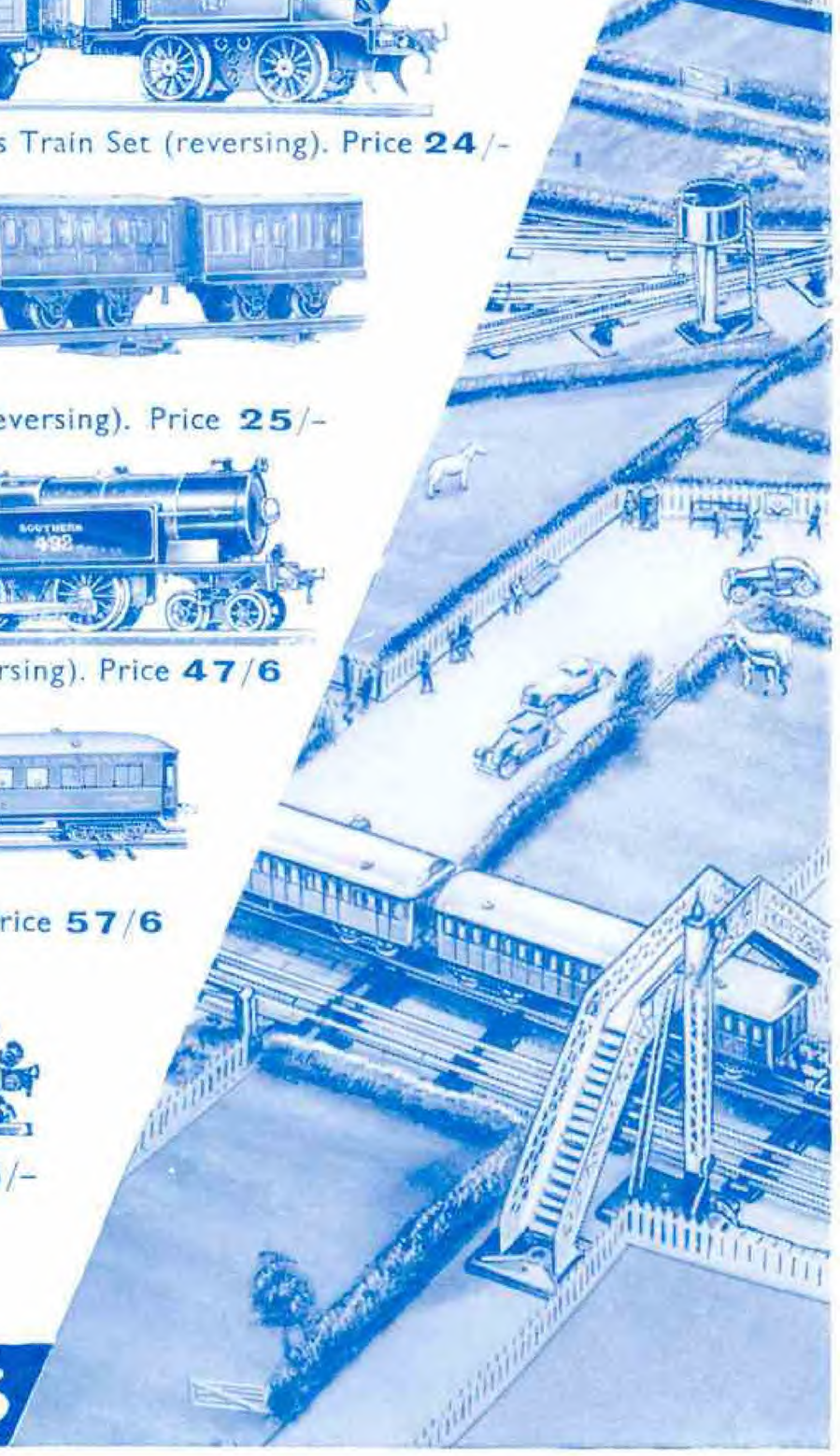


Hornby No. 3C Riviera "Blue" Clockwork Passenger Train Set (reversing). Price **57/6**



Hornby E220 Special Electric Pullman Set (20-Volt, automatic reversing). Price **75**/-

**Prices of Hornby Electric Trains Sets from 15/- to 75/-**
**Prices of Hornby Clockwork Trains Sets from 4/11 to 65/-**



**MECCANO LTD., LIVERPOOL 13**

EXTRA SPECIAL EDITION

SPECIAL SPEED DISPLAY

# Hamley's News

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200-202, REGENT ST., LONDON, W.I. OUR ONLY ADDRESS

*No. 40* *July, 1936*

ON LAND, SEA, AND IN THE AIR

## AT LAST! A REAL LIVE RACER!




The real thing at last! The "STUDIO" racing car Construction Set, mechanically perfect, based on the most successful Continental 200 m.p.h. racers. Beautiful streamline body leaves the *working differential*, steering gear, automatic clutch and fully sprung back-axle *visible for study*. Detachable wheels are secured by knock-on hub-caps, and rubber tyres are also detachable. Organise a race and time yourself on pit-stops. It's great fun, and *you'll learn a lot about cars and motoring*. Complete with tool kit. Price

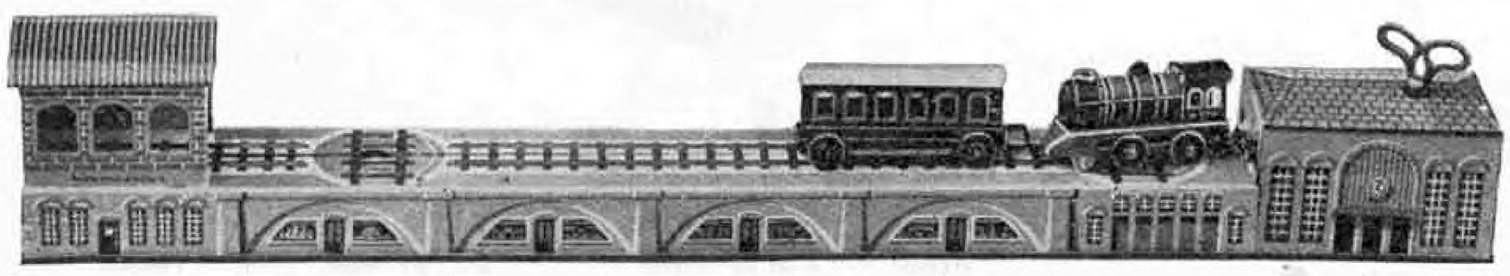
**5/-** Post 6d.

## NEW METHOD OF FLIGHT



The 'Welcom' BIRD-MAN GLIDER is a new design based on the methods of CLEM SOHN, the famous Bird Man, now demonstrating in this country. It catapults to an amazing height, then *flies, glides and loops*. Complete with catapult. Price

**1/-** Post 3d.



## SHUNTING TRAIN with automatic coupling

You'll be intrigued for hours with this new shunting train. It shunts forward, releases carriage, revolves on turntable, then automatically couples on to carriage for return journey. Price

**2/6** Post 4d.

## HAND LANTERN FOR HIKERS



For hikers or campers this hand lantern is ideal. Gives soft diffused light all around. Fitted with novelty switch, pick-up to light, put down to extinguish, and also permanent "on" switch. Perfect for use in tent. Complete with battery.

Price **2/11** Post 4d.

## TELESCOPE FOR THE HOLIDAYS



This powerful long-range telescope enables you to see ships at sea, and to spot your friends before they see you—very useful for scouting games! Price

**2/11** Post 4d.

## BATTLESHIP FIRES GUNS AT FULL SPEED AHEAD

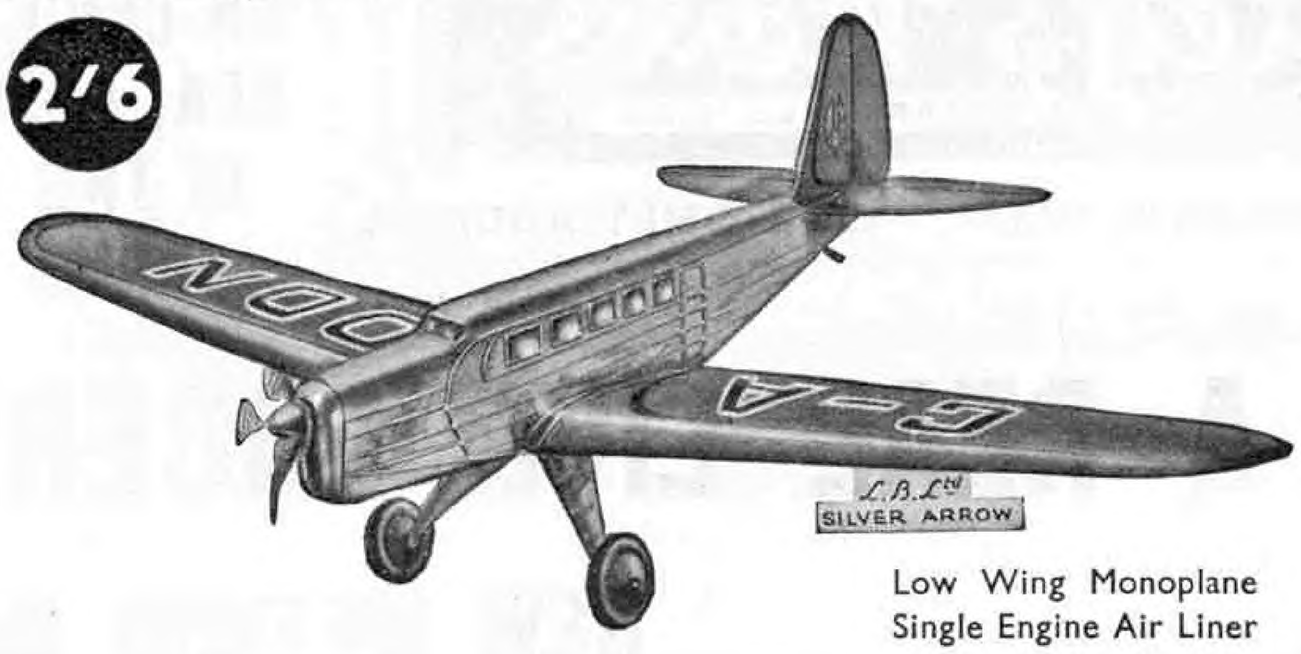


On the local pond or in the bath this battleship knocks spots off all comers. Powerful clockwork motor and sparking gun. Price

**2/6** Post 4d.

# SILVER ARROW

**2/6**




Low Wing Monoplane
Single Engine Air Liner

# FROG
## MODEL AIRCRAFT
## A REAL FLYING MODEL FOR ONLY HALF-A-CROWN

Read the specification: Aluminium fuselage; detachable propeller and nose piece; accurate pitch propeller; adjustable controls; transparent windows; wing span 16½ in.; spare motor and insertor rod; double-surface detachable wings. Flies 100 to 120 ft. To obtain the best results lubricate your elastic motor regularly with Frog Motor Lubricant. Price 2d. per bottle.

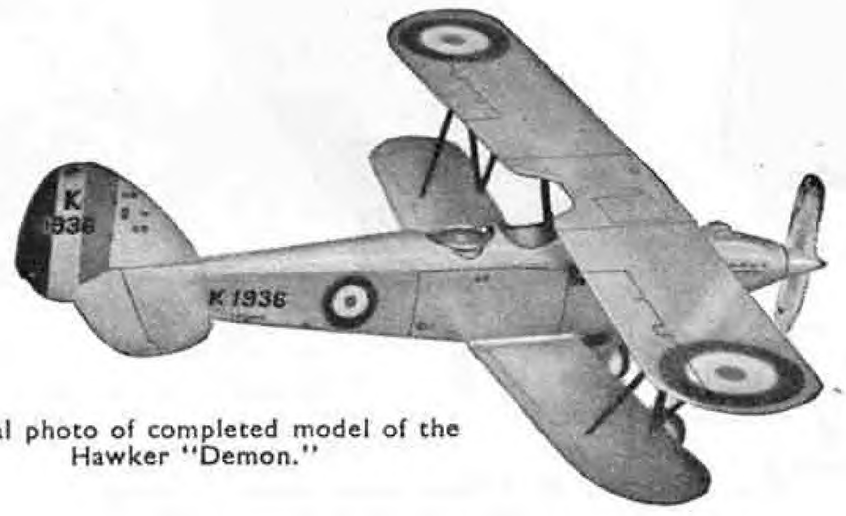
## New! Three low-priced flying scale model **CONSTRUCTION KITS**

**EASY TO BUILD — ALL PARTS BLANKED OUT**
**NO TOOLS REQUIRED**

De Havilland "LEOPARD MOTH" ... ... **2/6**
Wing Span 12¼ in. Length 9¼ in.

De Havilland "HORNET MOTH" ... ... **3/6**
Wing Span 11 in. Length 9¼ in.

Hawker "DEMON" 2-seater Fighter ... **4/6**
Wing Span 12¼ in. Length 11 in.




Actual photo of completed model of the Hawker "Demon."

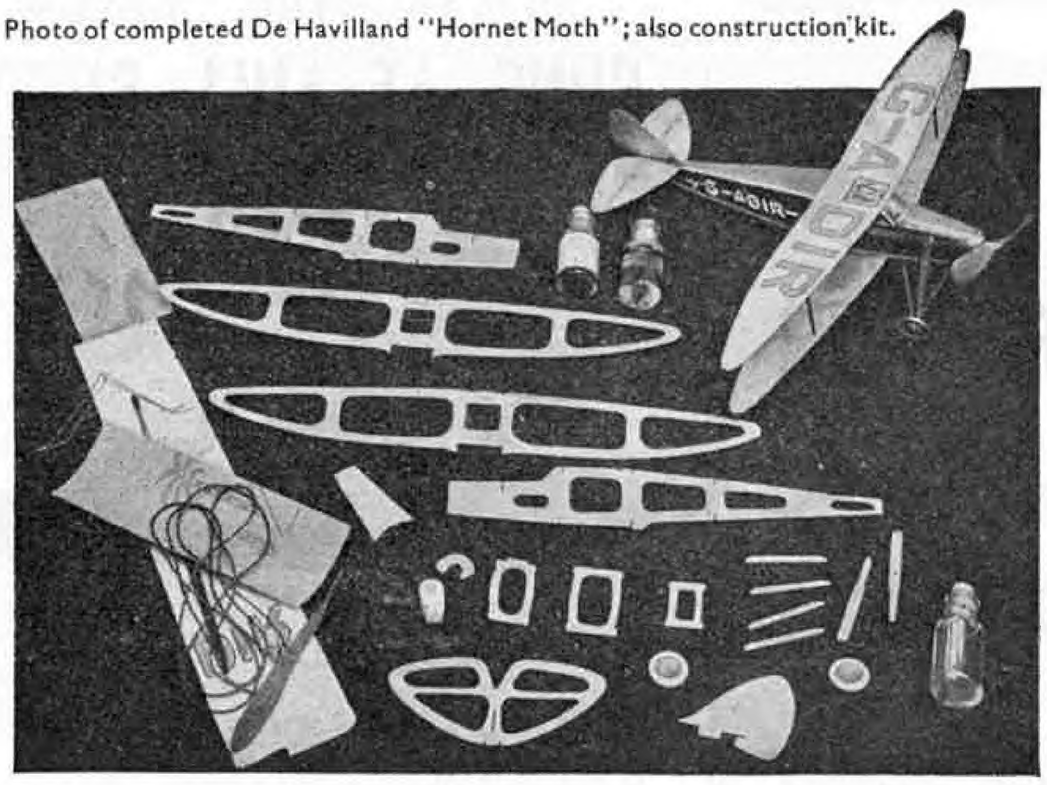
FROG TRADE MARK REGD.



Actual photo of completed model of De Havilland "Leopard Moth."

These construction kits enable the enthusiast to build his own Flying Scale Models. They are easy to build and no tools are required. All parts are blanked out and fit together perfectly, only needing to be glued. (This is supplied.) Wire parts are already bent to shape. No paint is required, all coverings are printed in the correct colours. Supplied complete with motor lubricant and spare motor.

Photo of completed De Havilland "Hornet Moth"; also construction kit.




**FREE FLIGHT INSTRUCTION**

Lines Bros. will give free flight instruction by appointment on the Frog Aerodrome at Merton. Telephone: Liberty 1041.

**COUPON** To Lines Bros. Ltd. (Dept. 5)
Morden Road, London, S.W.19

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled Air Force pilot badges.

NAME .....

ADDRESS .....

Please write in block letters. 7/36

Frog model aircraft designed and made by International Model Aircraft Ltd. Sole Concessionaires:

**LINES BROS. Ltd., Tri-ang Works, Morden Rd., London, S.W.19**

# Have you got YOUR souvenir miniature of the "Queen Mary"?

The Dinky Toys model of the R.M.S. "Queen Mary" is a splendid reproduction of the giant vessel on a scale of 1 in. to 150 ft., and it emphasises the graceful lines that make her the stateliest ship in the world. The external details, from the great wheelhouse and bridge to the motor lifeboats and the ventilators, are faithfully reproduced. The miniature is finished in correct Cunard White Star colours. Every British boy will be proud to own this fine model of the new British "Queen of the Seas."

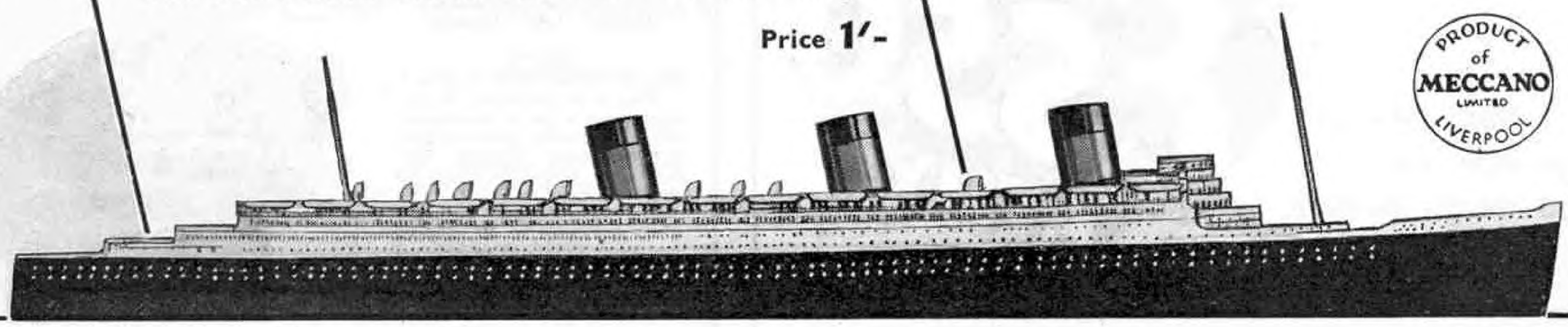
**DINKY TOYS**

**No. 52A Cunard White Star Liner "Queen Mary"**

**Price 1/-**




*The reception given to the R.M.S. "Queen Mary" on arrival at New York on her maiden voyage was remarkable in its exuberance and warmth. She is acclaimed on every hand as the outstanding achievement of modern maritime craftsmanship.*




# Wonderful Photographic News!

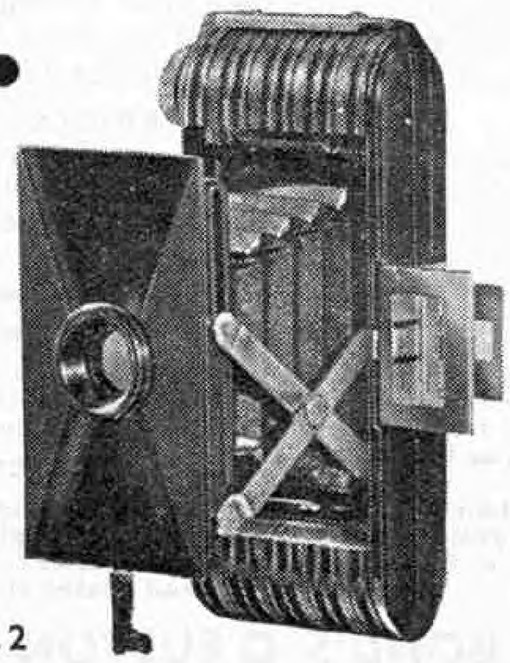
**There's a new folding Kodak for only 25/-**

# JIFFY "KODAK" V.P.

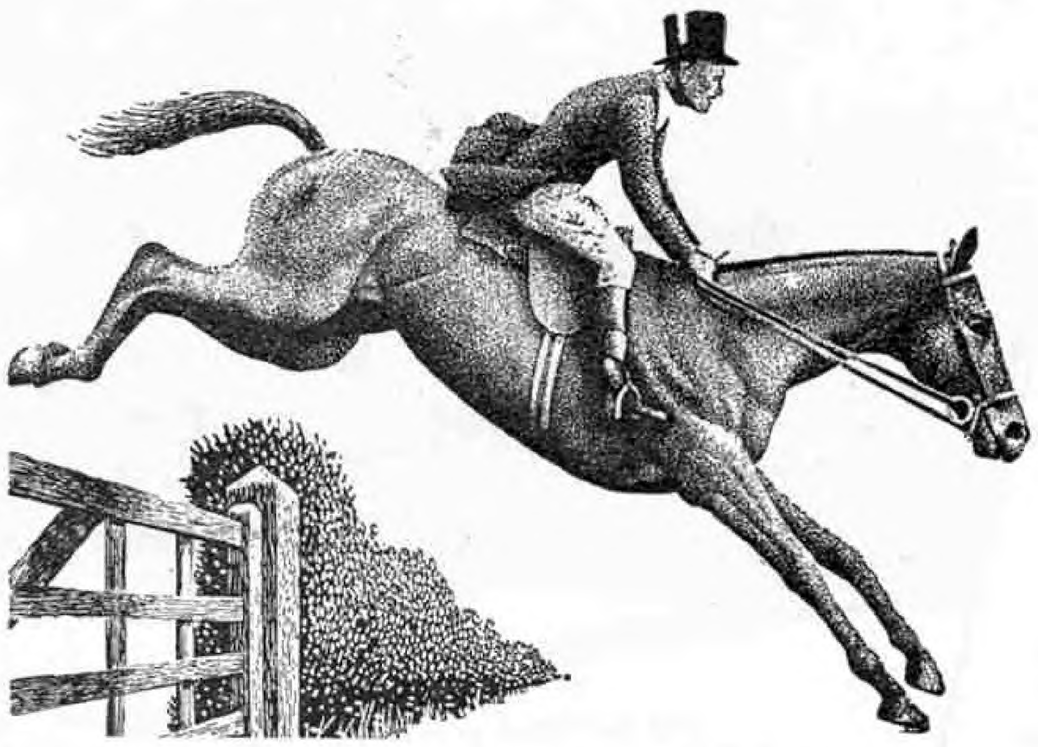
**(VEST POCKET)**

Small, light and very smart. Opens itself at the touch of a button. Fitted with fixed focus Kodak Doublet lens; shutter for Snapshot and Time exposures; eye-level viewfinder. Takes eight snaps $2\frac{1}{2}$" x $1\frac{5}{8}$" on a roll of V.P. Kodak Film.

Ask any Kodak Dealer to show you the Jiffy "Kodak" V.P. It's something quite new in low-priced folding cameras.



KODAK LIMITED, KODAK HOUSE, KINGSWAY, LONDON, W.C.2



# KNOCKLESS PERFORMANCE

ESSO ETHYL PETROL
ESSO HIGH TEST
ESSO BENZOL MIXTURE
ESSOLENE (For Commercial Vehicles)

ESSO ETHYL



# Balsa Model Aeroplanes

**REAL FLYERS**



We are offering the finest American Kits of parts ever put on the market for the Model Aeroplane Builder. All Kits are complete, including all Balsa wood, Japanese tissue, wheels, pins, wire, elastic and full-size Drawing with instructions.

**PRICES**

Kits for 16″ wing span flying model of the Fokker D/1, Nieuport XVII-Cl, Fairchild 22, Curtiss Falcon, Curtiss Goshawk, Fokker Triplane, Waco Model C, Howard "Ike." Price per Kit **1/3**, postage 3d.

Kits for 26″ wing span flying model of the Fokker D8, Nieuport XVII-Cl, Rearwin Speedster, Fairchild 22, Monocoupe 90A, Ryan Low Wing. Stearman, Curtiss Hawk. Price per Kit **2/6**, postage 4d.

Super Kits for building up 24″ wing span models which can be fully controlled from the cockpit, everything wanted is included in these Kits to make a Stinson Reliant, Curtiss Swift, Albatross D-5A, Spad, Hell Diver, Douglas 0-38. Price per Kit **7/6**, postage 6d.

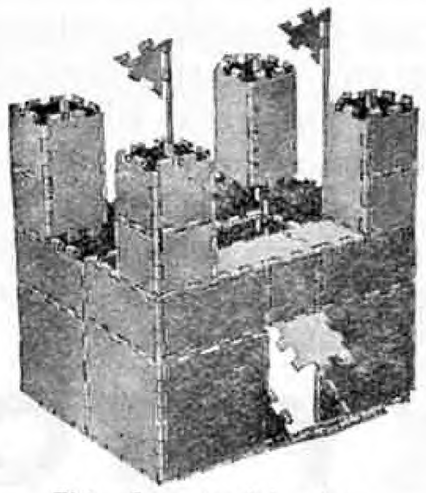
**Send for Bond's General Catalogue, price 6d. post free; this contains everything wanted for the Model Aeroplane maker, Model Railway builder from Gauge "O"–¾″ Scale, or the Model Ship Builder; also all Tools and Materials required.**

**BOND'S O'EUSTON ROAD LTD.**
**254, Euston Road, London, N.W.1**
'Phone: Museum 7137 Est. 1887



# DINKY BUILDER

## FOR BOYS AND GIRLS



This fine model of a castle is built with Outfit No. 2, plus two Dinky Builder "A" Packets.

Dinky Builder Outfits are great favourites with boys and girls. The parts contained in them provide a most fascinating constructional hobby, specially designed for the younger children. These brightly coloured parts are fitted together in a most simple and ingenious manner without the use of any nuts and bolts.

There are three Outfits in the series. No. O Outfit is available in bright red and green finish, while No. 1 and No. 2 Outfits can be obtained in bright red and green or in salmon pink and jade green finish.

**No. O DINKY BUILDER OUTFIT**
This is an excellent Outfit, containing a good assortment of Dinky Builder parts (including two road wheels), with which a splendid range of models can be built. The Instruction Folder included gives examples of 40 models, but many others of an original character may be constructed by the inventive boy or girl. **Price 2/6**




No. O Dinky Builder Outfit.



Motor Van built with No. 1 Dinky Builder Outfit.

**No. 1 DINKY BUILDER OUTFIT**
This fine Outfit contains a varied selection of parts, including a set of four road wheels for constructing miniature wheel toys, many examples of which are illustrated in the Instruction Folder. These instructions show a total of 70 fine models that any boy or girl can build. **Price 4/11**

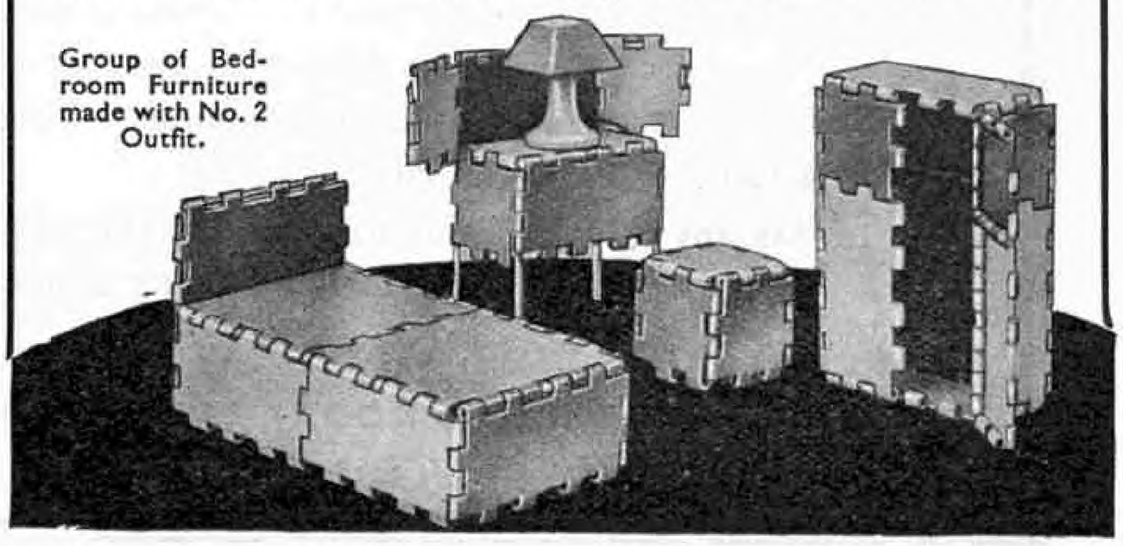
**No. 2 DINKY BUILDER OUTFIT**
This Outfit contains a comprehensive selection of parts with which all the No. O and No. 1 Outfits models can be built. In addition, the parts in this fine Outfit make possible the construction of seven groups of miniature model furniture. Full instructions are given in the Instruction Folders included in the Outfit. **Price 7/11**

**DINKY BUILDER "A"**
The Dinky Builder "A" packet contains a useful assortment of Dinky Builder Parts with which Outfits No. O, No. 1 and No. 2 can be supplemented. **Price 1/-**




No. 1 Dinky Builder Outfit.

Manufactured by
**MECCANO LIMITED, LIVERPOOL 13**



Group of Bedroom Furniture made with No. 2 Outfit.

# FROG scale models

FROG TRADE MARK REGD.




## FROG PUSS MOTH MONOPLANE

A handsome flying scale model of the famous De Havilland light aeroplane in which many records have been broken. Wing Span 18½". Length 13½". Complete with Patent High-Speed Winder Box, Spare Motors, Dual Insertor Rod, Motor Lubricant, Gear-box Oil and fully illustrated Instruction Manual. Flights of 600 ft. can be obtained under favourable conditions.

17/6

## FROG INTERCEPTOR FIGHTER MK.IV

The original and now famous flying scale-model Interceptor Fighter. Wing Span 11½". Duralumin Fuselage. Complete with Patent High-Speed Winder Box, Spare Motors, Insertor Rod, Motor Lubricant, Gear-box Oil and fully illustrated Instruction Manual. With practice it will fly 300 ft.

now only 5/-

**FREE FLIGHT INSTRUCTION**

Lines Bros. will give free flight instruction by appointment on the Frog Aerodrome at Merton.

Telephone: Liberty 1041.

**COUPON** To Lines Bros. Ltd. (Dept. 5) Morden Road, London, S.W.19

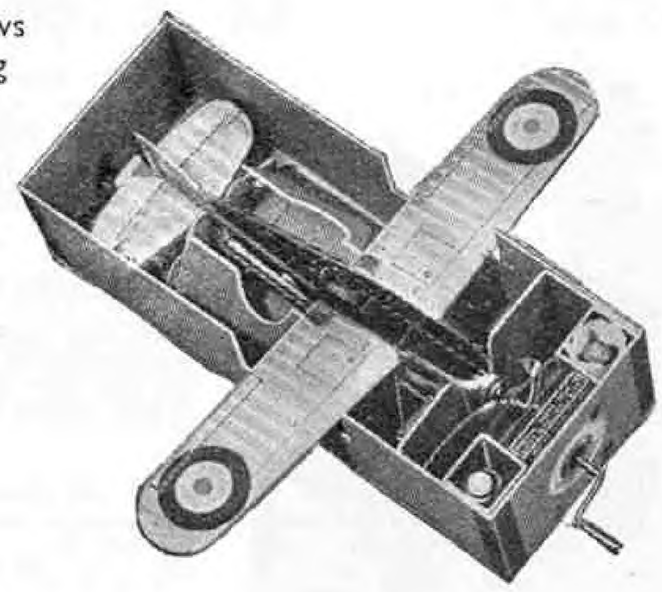
Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled Air Force pilot badges.

NAME .....

ADDRESS .....

Please write in block letters. 7/36

This illustration shows how quickly the Frog scale models are wound for flight with the geared-up winder box. A PATENT AND EXCLUSIVE "FROG" FEATURE.



Frog Scale model aircraft designed and made by International Model Aircraft Ltd. Patented throughout the world. Sole Concessionaires:

LINES BROS. LTD., Tri-ang Works, Morden Rd., Merton, London, S.W.19

# TOYS OF QUALITY MADE BY MECCANO LTD.

## AEROPLANE CONSTRUCTOR OUTFITS

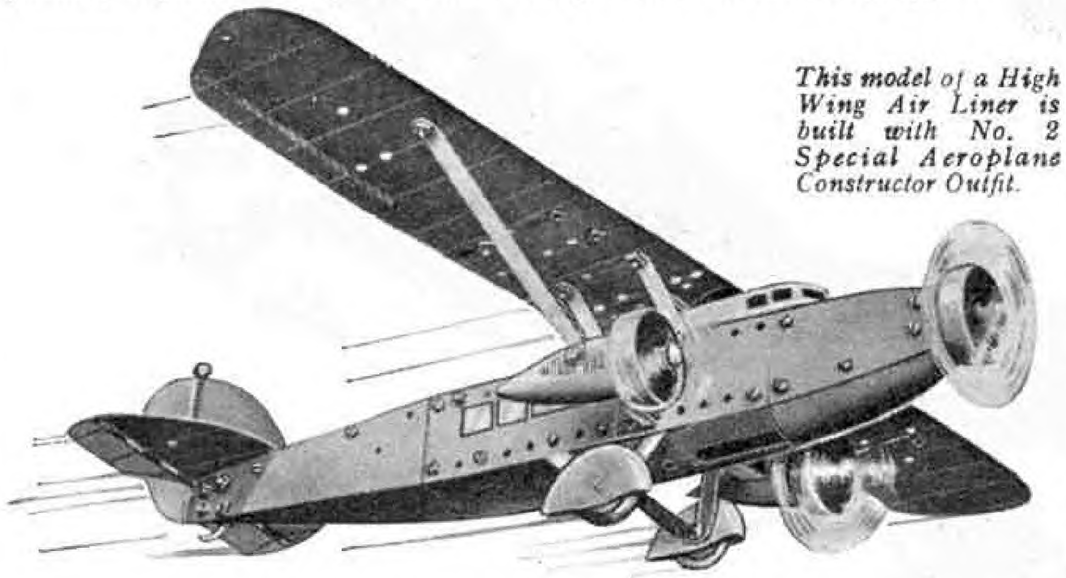



BOYS-BUILD YOUR OWN MODEL AIRCRAFT

No. 2 Aeroplane Outfit. Price **12/6**

Every boy should know how aeroplanes are designed and constructed, and should be able to recognise the different types of machines at a glance. These fine Constructor Outfits contain a range of aeroplane parts by means of which boys are able to design and build their own Aeroplanes quite easily.

The illustrated Manual of Instructions included in each Outfit shows how to build wonderful models of high and low wing Monoplanes, Biplanes, Seaplanes and many other interesting types.



*This model of a High Wing Air Liner is built with No. 2 Special Aeroplane Constructor Outfit.*

### Price List of Aeroplane Outfits.

**Standard Series.**

| | | | |
|---|---|---|---|
| No. OO Outfit ... ... ... | **3/3** | No. 1 Outfit ... ... ... | **7/6** |
| No. O Outfit ... ... ... | **4/6** | No. 2 Outfit ... ... ... | **12/6** |

**Special Series.**

| | |
|---|---|
| No. 1 Special Outfit ... ... | **12/6** |
| No. 2 Special Outfit ... ... | **21/-** |

*Note. The parts in the No. OO and No. O Outfits are not intended for use with the larger Outfits.*



### AEROPLANE HANGARS

**No. O1 AEROPLANE HANGAR** will accommodate one model made with the No. OO or No. O Outfits. Length 11½ in. Depth 10¼ in. Height 4¼ in. Price **4/6**

**No. O2 AEROPLANE HANGAR** will accommodate two models made with the No. O or No. OO Outfits. Length 21½ in. Depth 11 in. Height 6¼ in. Price **5/11**

## MOTOR CAR CONSTRUCTOR OUTFITS

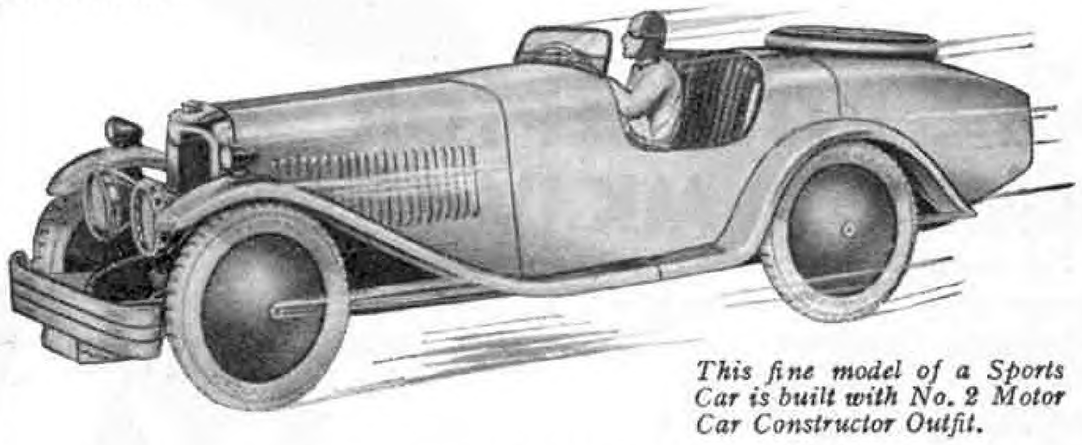
YOU WILL BE KEEN TO HAVE ONE!




No. 1 Motor Car Outfit. Price **10/-**

Boys, as soon as you see these fine Motor Car Constructor Outfits you will be keen to have one. The models they build are superb—sports four-seaters, coupés, speed cars and other perfect miniature reproductions, each one a beautiful model of its prototype.

The motor car parts are finished in rich enamel, nickel plate and chromium.



*This fine model of a Sports Car is built with No. 2 Motor Car Constructor Outfit.*

### No. 1 MOTOR CAR CONSTRUCTOR OUTFIT

The motor car models that can be built with this Outfit are perfect examples of miniature automobile construction. Think of the fine fun you could have building these wonderful models, each one of which faithfully resembles its prototype. No. 1 Outfit is supplied complete with powerful Clockwork Motor. Price **10/-**

### No. 2 MOTOR CAR CONSTRUCTOR OUTFIT

Larger models of a superior type can be built with No. 2 Outfit. Their handsome and realistic appearance may be judged from the model illustrated above.

A powerful Clockwork Motor that gives a run of 150 feet on one winding is included in the Outfit. Price **20/-**



Motor Car Garage

### MOTOR CAR LIGHTING SET

With this Lighting Set the headlamps of Motor Car models built with the No. 2 Motor Car Outfit can be electrically lighted. Price **2/6**

### MOTOR CAR GARAGE

This realistic Motor Car Garage provides accommodation for any Meccano model motor car or other cars of suitable size. Inside dimensions: Height 5 in. Length 13 in. Width 7¾ in. Price **5/6**

MECCANO LTD., BINNS ROAD, LIVERPOOL 13

# WARNEFORD




SUPER PERFORMANCE

## Model Aircraft



The truly amazing long distance flights so easily obtainable with Warneford Models has made them famous throughout the World.

There is a fine range of models from 1/6 to 5 guineas with flights ranging from 500 to 2,500 ft. The price list, post free on application to the address below, contains a full description of them all.

The
**"PARA-SHOOTER"**
Patent No. 371470.
Quite the most fascinating novelty of the year. You will be thrilled by this realistic parachute descent.

**Price 1/- each**



**From good stores, toy shops and Sports dealers everywhere.**

**WARNEFORD FLYING AIRCRAFT**
GREENWICH, LONDON, S.E.10

*All the best cycles have* **Bluemel's**
REG'D

**PUMPS**




**DEPENDABLE & EVER-LASTING**

You will nearly always find that experienced clubmen, the people who **know,** have Bluemel's celluloid pumps on their machines. You can get one for as little as 1/6 (Metal pumps 1/–).

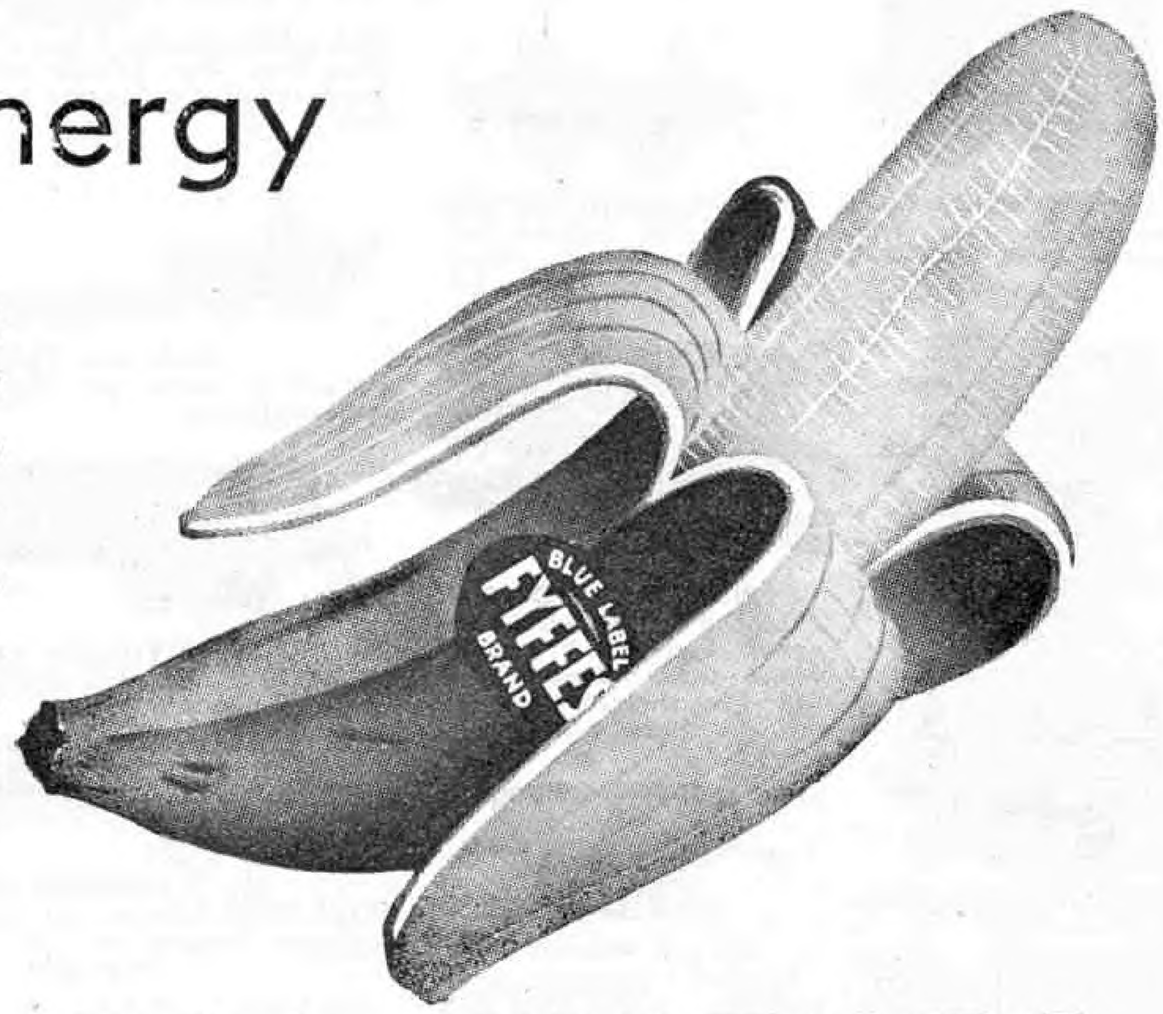
*Write now for pocket catalogue of accessories containing useful cycling information.*

**BLUEMEL BROS. LTD. DEPT. 27, WOLSTON, COVENTRY**

# *Have a banana*

## the fruit for energy

Have a banana when you're feeling tired. There's no quicker and healthier way of restoring your vitality. For ripe bananas are rich in natural glucose—that wonderful fruit sugar which turns itself into energy in the body—*at once.* And what delicious fruit! So good for you. No trouble to eat. And such good value for money.



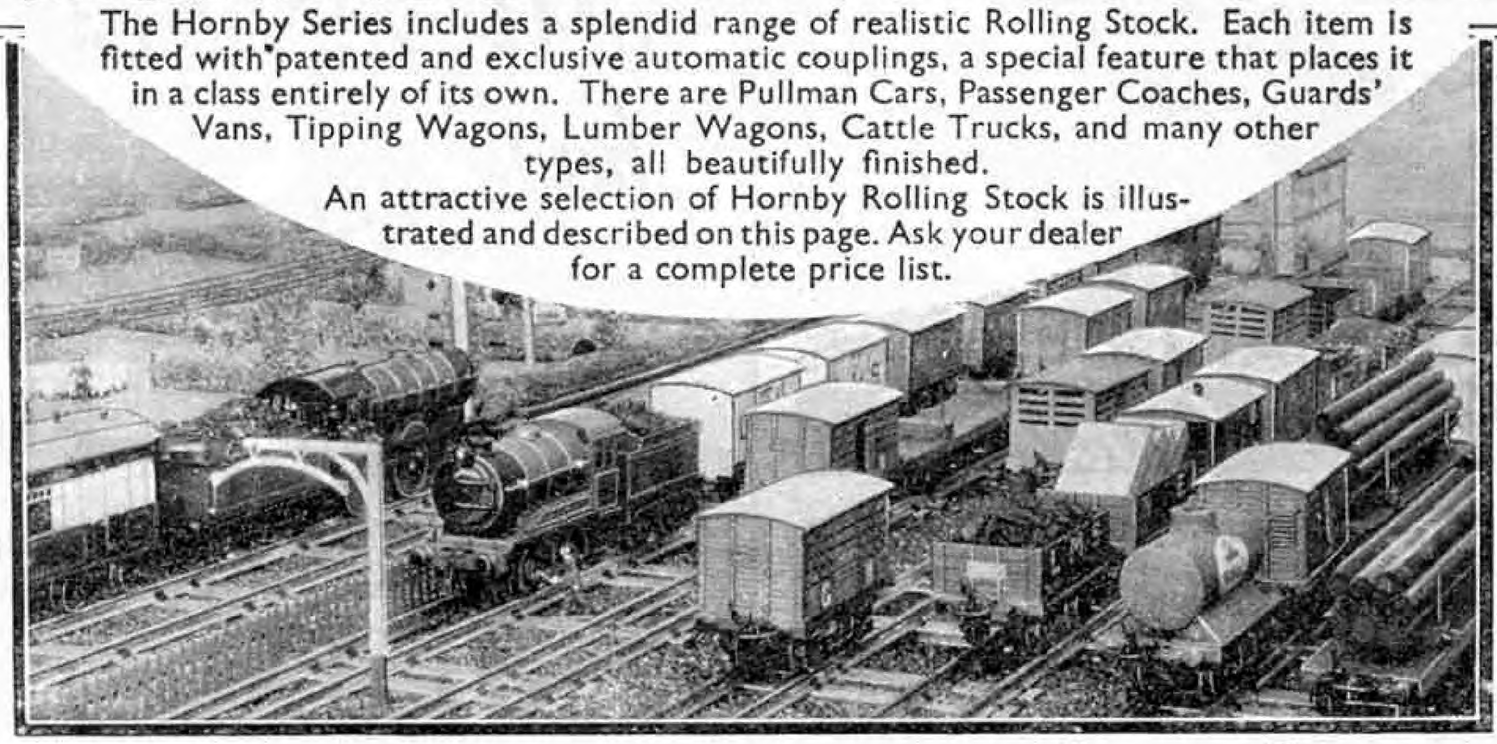

# FEEL FINE ON **FYFFES**

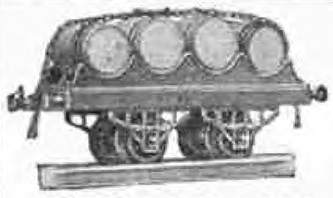
HORNBY SERIES

# HORNBY ROLLING STOCK

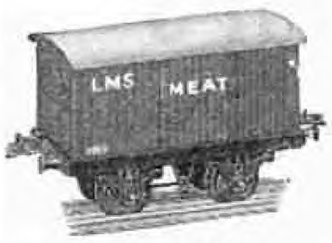
GAUGE O

The Hornby Series includes a splendid range of realistic Rolling Stock. Each item is fitted with patented and exclusive automatic couplings, a special feature that places it in a class entirely of its own. There are Pullman Cars, Passenger Coaches, Guards' Vans, Tipping Wagons, Lumber Wagons, Cattle Trucks, and many other types, all beautifully finished.
An attractive selection of Hornby Rolling Stock is illustrated and described on this page. Ask your dealer for a complete price list.





**BARREL WAGON**
This is an interesting model of a type of wagon used in France and other European countries.
Price **2/6**




**MEAT VAN**
A very realistic model. Available lettered L.M.S. only. Price **1/9**




**No. O ROTARY TIPPING WAGON**
Price **1/6**



**No. 1 SIDE TIPPING WAGON**
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/-**



**No. 1 TIMBER WAGON**
Beautifully enamelled in yellow and red. Price **1/6**




***GUNPOWDER VAN**
Finished in red. With opening doors. Price **2/9**




**BITUMEN TANK WAGON "COLAS"**
Finished in blue.
Price **3/6**



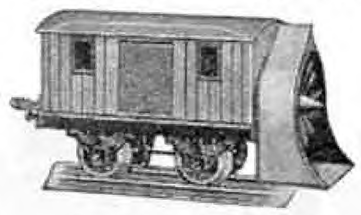

**No. O MILK TRAFFIC VAN**
An attractive model Available lettered G.W. only Price **1/9**




**No. 1 BANANA VAN "FYFFES"**
An attractive model, finished in yellow and red. Price **2/9**



**WINE WAGON DOUBLE BARREL**
An attractive model artistically enamelled in red and green. Price **4/6**



**SNOW PLOUGH**
With revolving plough.
Price **3/9**



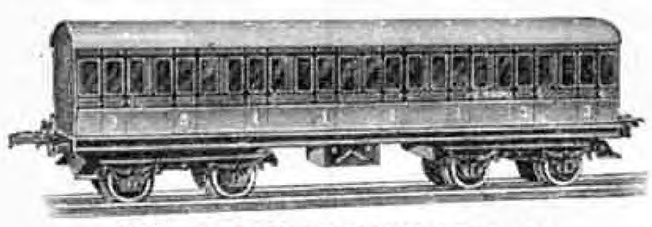
**No. 1 LUMBER WAGON**
Fitted with bolsters and stanchions for log transport. Price **1/6**



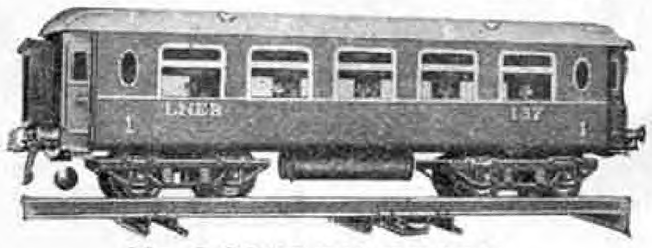
**No. O "MITROPA" COACH**
Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold.
Price **1/6**



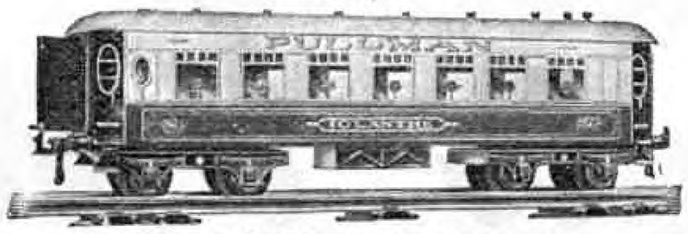

**COAL WAGON**
Fitted with embossed representation of coal. Price **2/3**



***No. 2 PASSENGER COACH**
Suitable for 2 ft. radius rails only. First-third or Brake-third. Price **7/6**




**No. 2 SALOON COACH**
Realistic in design and beautifully finished. Two types are available: L.N.E.R. (as illustrated) enamelled brown, and L.M.S. enamelled maroon. Suitable for 2-ft. radius rails only.
Price **9/6**




**No. 2 SPECIAL PULLMAN COACH**
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only.
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**TROLLEY WAGON**
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **3/9**



**No. 2 TIMBER WAGON**
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **2/6**



**No 2 LUMBER WAGON**
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft radius rails only.
Price **2/11**

*In L.M.S. L.N.E.R., G.W. or S.R. lettering.*



**OIL TANK WAGON "CASTROL"**
An attractive model. Enamelled green with lettering in red. Price **2/-**



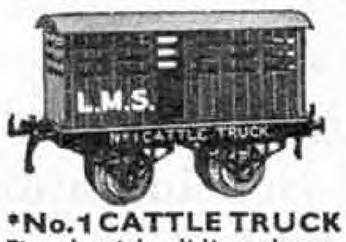

**COVERED WAGON (French Type)**
This wagon is fitted with frame and sheet. Lettered "Nord."
Price **2/6**




***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors.
Price **2/9**



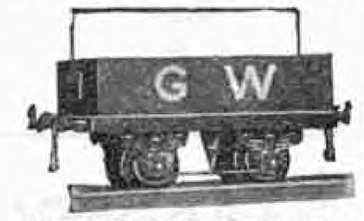
**No. 1 CRANE TRUCK**
Finished in brown and blue. Price **2/11**




***No. 1 CATTLE TRUCK**
Fitted with sliding doors. Very realistic design.
Price **2/9**




**FISH VAN**
This is a distinctive model. Available lettered N.E. only
Price **1/9**




***OPEN WAGON "B"**
Fitted with centre tarpaulin supporting rail.
Price **2/-**




**No. 1 ROTARY TIPPING WAGON**
Finished in orange.
Price **2/6**




**CHOCOLATE VAN "CADBURY'S"**
This van is beautifully enamelled in blue with white roof. Price **2/9**



***HOPPER WAGON**
Mechanically unloaded.
Finished in green. Price **3/6**




**MILK TANK WAGON "UNITED DAIRIES"**
A very realistic model, finished in blue and white.
Price **4/6**




**CEMENT WAGON**
The door at the top opens
Finished in bright red
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MECCANO LIMITED -- BINNS ROAD -- LIVERPOOL 13

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# These are Hornby Speed Boat Days

Model speed boat racing is one of the most thrilling hobbies you can have, brimful of excitement from start to finish. But the amount of fun you get depends on the kind of boat that flies your colours. That's why you'll be proud to own a Hornby—every inch a champion, sleek, smart and swift. A winner against all comers!

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When other boats are slowing up, the Hornby Speed Boats are still going strong. The special design of the propeller and the unique methods employed in the construction of the hull give each model exceptional speed and length of run.

These fine boats are built with the same precision and craftsmanship as the famous Hornby Trains. You will be amazed at their outstanding performance—the No. 3 Speed Boat does a snappy run of over 500 feet on one winding!

## HORNBY RACING BOATS

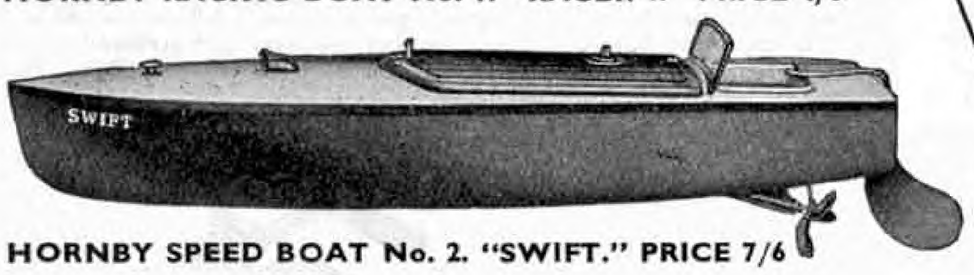
The series of Hornby Racing Boats is composed of three exceptionally fine models that are "quick off the mark," and which maintain a high rate of speed throughout the whole length of their run. Their remarkable performance, perfect design and beautiful appearance have already gained for them a unique popularity among boys.




HORNBY SPEED BOAT No. 1. "HAWK." PRICE 2/11



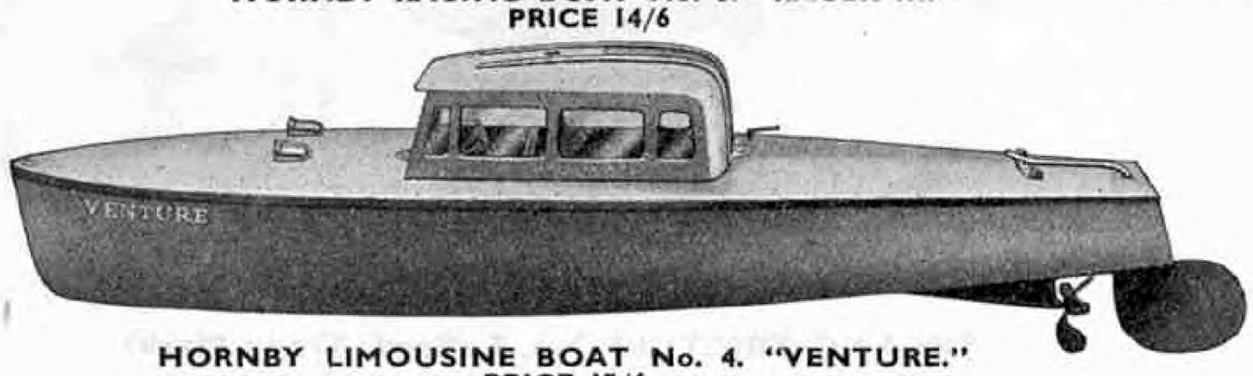

HORNBY RACING BOAT No. 1. "RACER I." PRICE 4/6




HORNBY SPEED BOAT No. 2. "SWIFT." PRICE 7/6




HORNBY RACING BOAT No. 3. "RACER III."
PRICE 14/6




HORNBY LIMOUSINE BOAT No. 4. "VENTURE."
PRICE 15/6

## PRICE LIST

### HORNBY SPEED BOATS

| | |
|---|---|
| HORNBY SPEED BOAT No. 1. "HAWK" ... ... ... | Price **2/11** |
| HORNBY SPEED BOAT No. 2. "SWIFT" ... ... ... | Price **7/6** |
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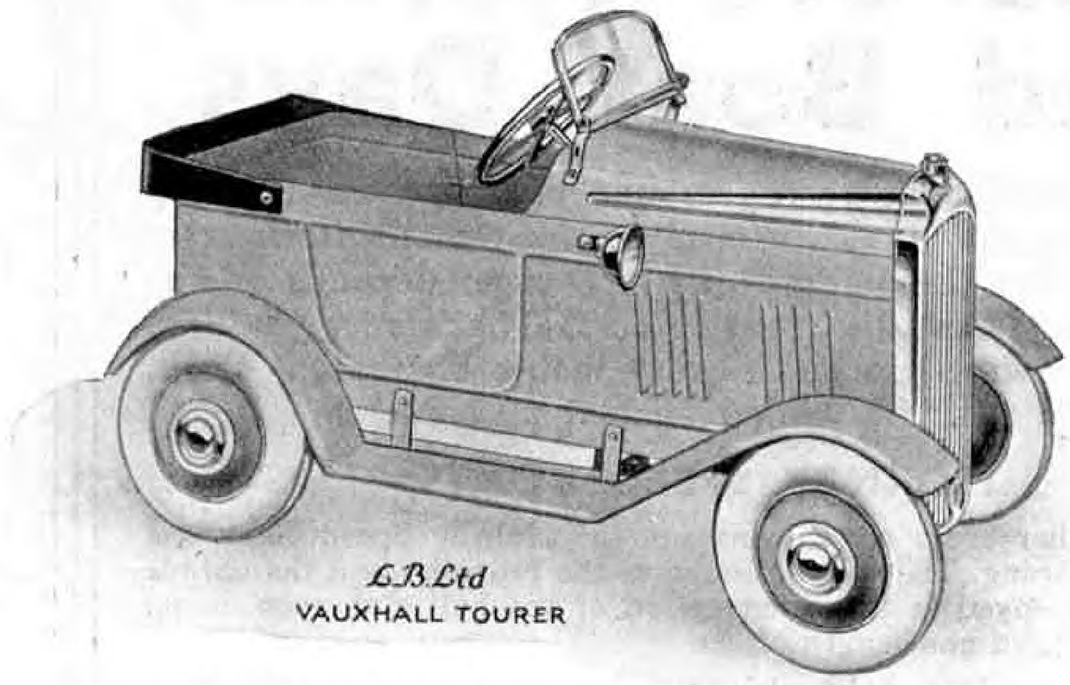
**HORNBY SPEED BOATS**

# TRI-ANG

L. BROS. LTD. LONDON BROS ENGLAND

REGD. TRADE MARK

## MODERN CARS FOR MODERN BOYS



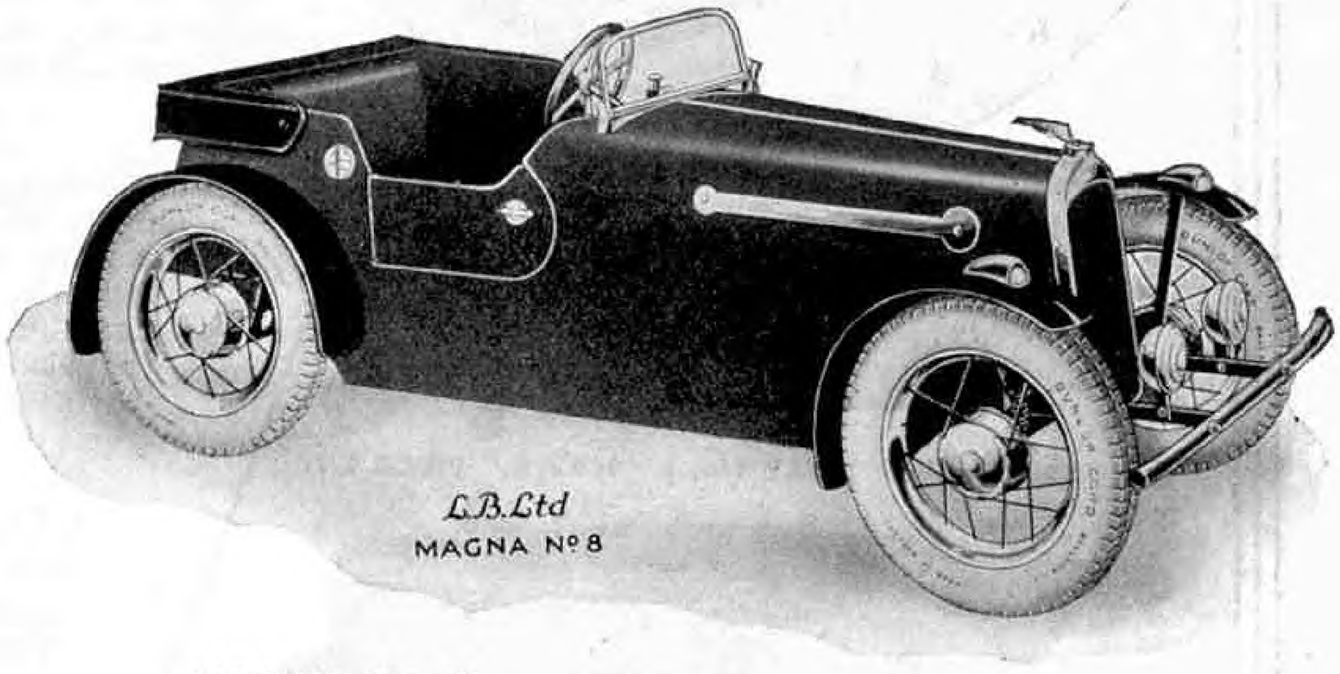

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New model. Pressed steel body with opening side door. Windscreen, dummy hood, facsimile Vauxhall bonnet and radiator. 8 in. balloon disc wheels, ½ in. rubber tyres. Two dummy side lamps. Petrol and oil cans. Length 32 in. RETAIL PRICE **22/6**




### TRI-ANG SPECIAL

Entirely new Streamline model. Steel body with opening side door and luggage boot. Tangent spoke wheels, 1 in. cushion tyres. CHROMIUM-PLATED bumper, rims and streamline dummy side lamps. Windscreen, direction indicator and dummy hood. Length 41 ins. RETAIL PRICE **42/-**




### MAGNA No. 8

A magnificent new sporting car. Coach built body fully sprung. Ball-bearing back axle. Opening side door, windscreen, dummy hood and lamps. Tubular bumper. Dunlop pneumatic tyres on tangent spoke wheels. All bright parts CHROMIUM PLATED including hubs and rims, louvres, bumper and streamline mascot. Length 54 ins. RETAIL PRICE **115/-**




### TRI-ANG "FAIRYCYCLE" (Regd.) MODEL No. 2

Tubular frame. 14 in. wheels. 1⅛ in. grey imitation pneumatic tyres. Ball-bearing pedals. Rim brake. Two coil saddle. Chain cover. Stand. CHROMIUM-PLATED FITTINGS. Black, blue or maroon. RETAIL PRICE **39/6**




### TRI-ANG TRICYCLE No. 5 (Regd. Trade Mark)

FITTED WITH REAR MUDGUARDS. Cycle chain drive with free-wheel. Frame best quality weldless cycle tubing. 14 in. wheels. 1⅛ in. jointless sponge-rubber tyres. Rim brake. Coil-spring saddle. CHROMIUM FITTINGS. Black, blue or maroon. RETAIL PRICE **59/6**

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NEXT MONTH: "TEST FLYING GIANT AIR LINERS." PUBLISHING DATE: 1st AUGUST


# MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

Volume XXI. No. 7
July, 1936


# With the Editor

## Something to Think About

One of the most interesting features of my correspondence is the large number of letters I receive from readers asking me to solve some problem that is puzzling them. I am always glad to receive these queries and to do my best to answer them satisfactorily. I confess that some of the problems make me put on my thinking cap. They deal with almost every subject under the Sun, and show how keen "*M.M.*" readers are to acquire all kinds of useful and definite knowledge.

Many of these enquiries deal with various forms of mechanism for perpetual motion, the hoary old impossibility that has worried inventors of all Ages and still attracts eager enquirers. Some of the perpetual motion schemes are so ingenious that it takes a good deal of careful examination to find the flaw that makes their working impossible. Before long I hope to publish an article dealing with some of the more interesting perpetual motion devices, past and present. Other readers are concerned with such matters as the speed of a wasp flying across a compartment in a rapidly-moving train; others want to know if the guard of an express train could shoot the engine driver if the speed of the bullet from his gun were the same as that of the train. I have been asked also if it would be possible to travel from England to America in a balloon by simply rising straight up in the air and descending several hours later when the world has turned round and America is directly underneath! Then of course there is the old problem as to what would happen if an irresistible force encountered an immovable object!

## A New Feature

Many of the problems submitted to me are of general interest, and I intend to deal with a selection of them in a new "*M.M.*" feature under the heading "*Something to Think About.*" The first article in this series appears on page 402 of this issue, and deals with an imaginary journey through a shaft driven through the centre of the Earth from England to Australia. The reader who first wrote to me about this gigantic shaft wanted to know whether a person going through it would emerge feet first or head first on reaching Australia, and his enquiry leads to many interesting and curious results.

I shall be glad to know what my readers think of this article, and to receive suggestions for other problems that are suitable for inclusion in the series. Problems submitted should not involve any mathematical calculations, and should be capable of being illustrated by a photograph or a drawing. Payment will be made for any problem accepted for publication.

## Speeding Up Railway Services

It is interesting to find that on the sixth of this month the time required by "*The Flying Scotsman*" to travel from London to Edinburgh is to be reduced to 7¼ hours. This is 15 minutes less than the time now taken, which four years ago was reduced from the 8¼ hours that had been customary for many years. There is an even greater saving in the journey onward to Aberdeen, which is now brought 57 minutes nearer London. Similar changes have been made in the running of other L.N.E.R. main line trains, and also of the L.M.S.R. Anglo-Scottish trains. For instance, the time to reach Glasgow from London by "*The Royal Scot*" is to be reduced by 10 minutes, so that the journey will occupy only 7½ hours.

This news is distinctly cheering both to railway enthusiasts and to travellers. The actual reductions may not appear very large, but it must be remembered that in recent years trains have increased considerably in weight because greater attention is being paid to the comfort of passengers. Present-day locomotives have to deal with loads of 450 to 500 tons, or even more. With these they are making better times than those engaged in the famous races of half a century ago, when a few small coaches only had to be hauled, and the speeds attained were thought to be dangerous.

## Day Trips By Air

However much railway services are accelerated, they can never compete with flying as far as speed is concerned. It is almost incredible to realise that most of Europe's capitals, including places as far away as Budapest, Rome and Madrid, can now be reached from London in a day by air, and to-day a new Imperial Airways service begins that adds Stockholm to this list.

It is even more remarkable to find that day trips can be made as far afield as Switzerland. One can fly over to Zurich in time for lunch, and after a short stay there return to London the same evening. Similarly an early service from Croydon enables several hours to be spent in Copenhagen before returning the same night.

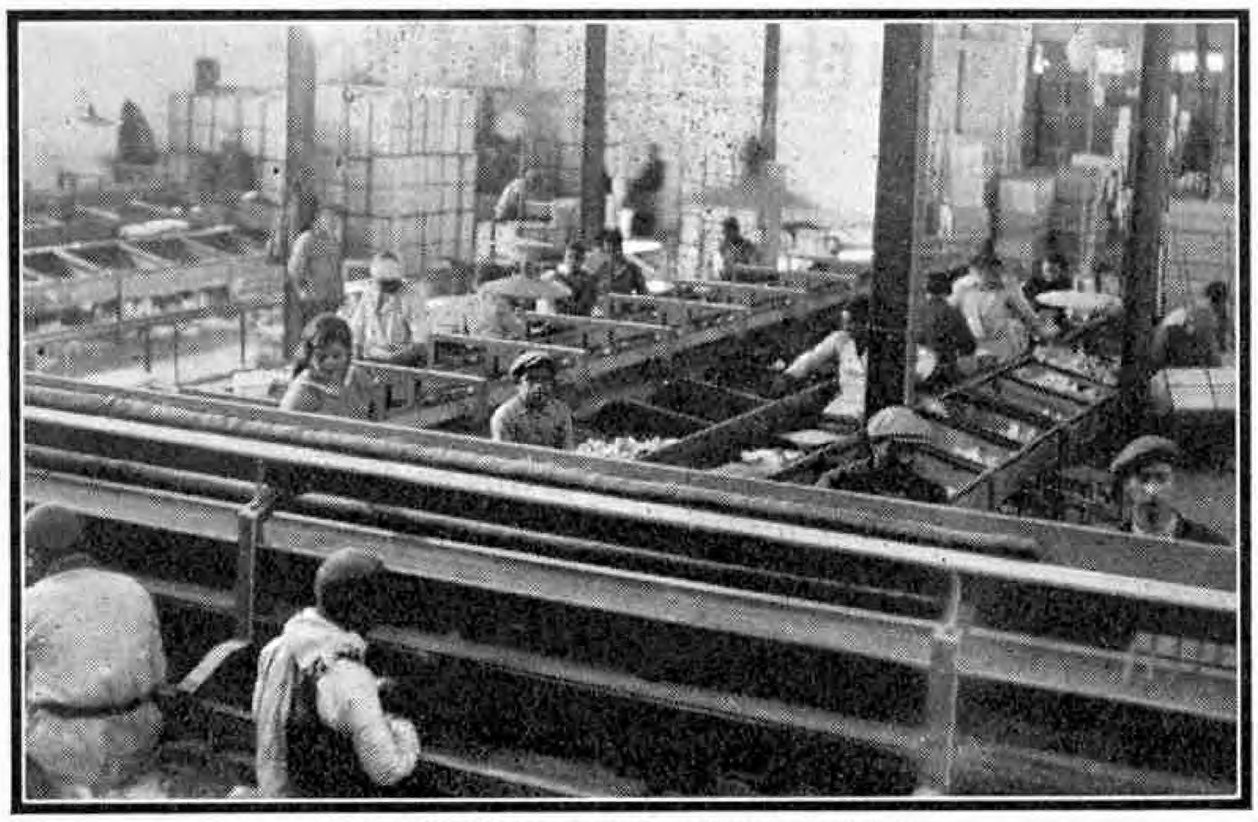
Flying services indeed are opening up Europe to us. It is only a few years since a journey even to Belgium or Northern France involved a long and troublesome journey, partly by rail and partly by water. Ostend, Le Touquet and other seaside resorts across the English Channel can be reached in an hour or two, and are now as near London as Brighton was in pre-War days. In the course of a single week visits actually can be made by existing air routes to France, Switzerland, Italy, Spain, Germany and Scandinavia.

# The Romance of the Jaffa Orange

## A Growing Palestine Industry

By H. J. Shepstone, F.R.G.S.

THE story of the Jaffa orange is a romance of industry. Some 80 years ago the British Consular Agent at Jaffa sent a few boxes of Jaffa oranges to Queen Victoria. They were the first boxes of oranges to be shipped out of the country, and it was a little time before the Jaffa came upon the ordinary market, but by 1913 the export of oranges from Palestine totalled about half a million cases. The fruit was given its name because it is grown in the groves around Jaffa. Its production then was virtually an Arab industry, for Arabs were responsible for its cultivation, picking, packing and transport to the steamers at Jaffa.



A modern orange packing warehouse in Palestine.

After the War the number of cases exported fell considerably and the half-million mark was not reached till 1929. Since then the industry has gone ahead by leaps and bounds, and the number of cases of oranges now exported is between five and six million in a season, together with more than a million boxes of grapefruit. No other fruit-producing country can point to such a phenomenal growth in any of its products. As an exporter of oranges Palestine is second only to Spain, and as an exporter of grapefruit she heads the list.

The Jaffa orange has won universal favour because of its high qualities, for in juice content, flavour, fragrance and pleasant shape it excels all other varieties. Its cultivation to-day is the principal industry of the Holy Land. Not only is it the greatest factor in the economic life of the country, but it is fast becoming an important factor in the citrus industry of the whole world.



Fumigating the trees in the orange groves at Jaffa to destroy insect pests.

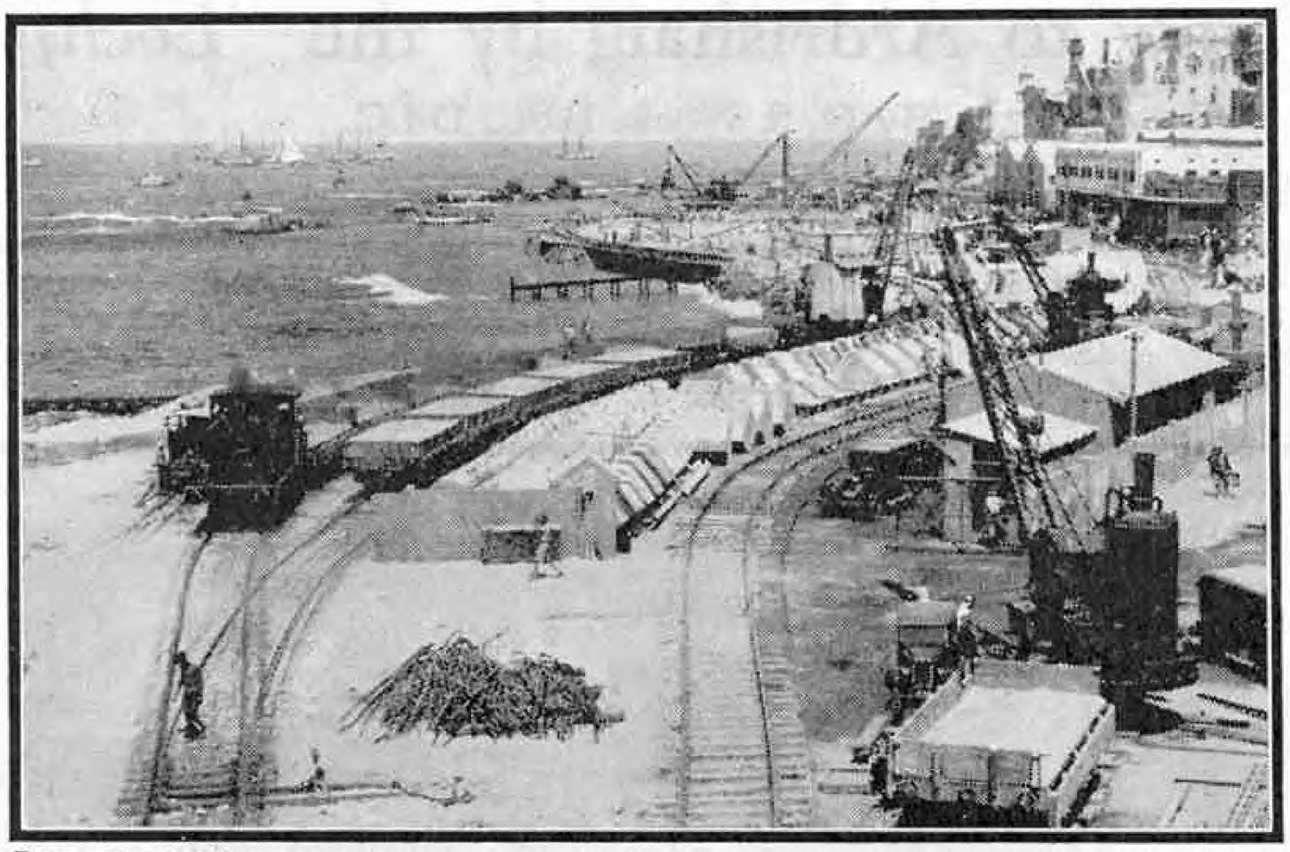
There is something attractive about an orange grove. The luscious fruit is grown on what is really an immense bush rather than a tree. At blossom time an orange grove is a fairyland picture come true, for it is one blaze of beautiful white flowers, intoxicating the air with their scent, which often can be detected miles away and off Jaffa even envelops ships far out at sea. The leaves of the plant are a beautiful dark, velvety green. At first the fruit is green, and it turns gradually to a lovely golden tint affording a striking contrast to the dark rich colour of the leaves.

The trees are grown from carefully selected seedlings, the seeds being planted in a seed bed in close rows. There the young plants remain for 12 months, by which time they are ready for transporting into the nurseries. At the end of the second year, they are budded to the variety desired, for even among Jaffas there are several varieties, and the tree is planted in the orchard or grove. It is carefully watched for the next two years, when it should be bearing its quota of fruit. The principal duty of the grower now is to keep the grove free of weeds and see that it is efficiently irrigated. This is done by means of furrows ploughed between the rows of trees along which the water is allowed to flow.

In gathering the fruit considerable care is called for. Oranges must not be plucked roughly from the tree. Each has to be clipped off carefully so as not to cut either the skin or peel of the fruit, or the buttons on the stem centre. Care is taken to avoid scratching the fruit on the limbs of the tree, or when placing it in the picker's bag, as skin punctures would result in rapid decay. From the pickers' bags the oranges are transferred to field boxes, which are carted to the packing houses, where the fruit is washed, dried, graded, wrapped, and packed ready for transport.

The packing houses are model establishments of their kind, possessing the latest labour-saving devices

for the rapid and efficient handling of the fruit. At present there are some 70,000 acres under citrus fruit in Palestine, but the area is being rapidly extended. Mr. S. Tolkowsky, Chairman of the Jaffa Citrus Exchange, declares that if the present rate of planting continues—and there is no sign of its abating—the total available crop for export 10 years hence will be somewhere in the neighbourhood of 20 million cases. About 65 per cent. of the industry is in Jewish hands, the remaining 35 per cent. being controlled by the Arabs.



Reconstructing the ancient harbour at Jaffa. A portion of the foreshore is being reclaimed for the erection of a large orange and transit shed.

In order to facilitate the handling of this ever-increasing volume of fruit, some interesting improvements are being carried out at the port of Jaffa. In a word, what the engineers are doing is reconstructing the old harbour used by Solomon in Bible times. Strictly speaking, there is no harbour at Jaffa capable of accommodating modern steamers, but only a small rock-protected shelter. Running parallel to the town is a belt of rocks that lie awash, about 300 ft. to 400 ft. from the shore, forming a barrier that presents both a refuge and a menace. To the smaller craft, such as lighters and small sailing boats, capable of being steered by adroit seamen through their rocky gateway barely 20 yds. wide, the sheltered waters behind them are a haven of refuge; but to the modern cargo steamer the rocks, with their submerged extensions, constitute a peril to be avoided at all costs.

The reef to-day is very jagged and broken, and consists of soft rock. In Hebrew times it probably was much more pronounced, running more evenly and standing higher out of the water, thus acting as a natural breakwater to shipping lying within the sheltered area. The engineers are restoring this old harbour of Solomon by converting the rocky reef into a massive mole or sea wall; the dangerous submerged extensions are being blasted away, a proper entrance is being constructed, and the sheltered water dredged to a depth of 10 ft. to 12 ft. The harbour will not be able to accommodate large steamers, but they will be able to lie to the north of the entrance in a much safer position than in the roadstead off the port. A portion of the foreshore also is being reclaimed, and upon it wharves are being built as well as a transit shed capable of holding 250,000 cases of oranges.

Another reason for carrying out these improvements at Jaffa is to attract the better type of cargo boat. Both the Palestine Government and the growers realise that if a market is to be found for their fruit it must be conveyed quickly to the markets of Europe. Whereas 19 to 20 days was the average duration of the voyage a few years ago, the best steamers engaged in the trade are now taking only 12 to 13 days from Jaffa to Liverpool or Glasgow, and even to Hamburg. The shorter the voyage, the less the waste.

Everything possible is being done to push the sale of the fruit in overseas markets. There is a special Government Inspection Service to see that only fruit in first-class condition is exported. Ugly and unshapely fruit is thrown on one side, and if an orange has to travel overseas it should have been picked and packed just before it is ripe. In order to increase the sale of the fruit the Government have created a fund for propaganda and advertising by a levy on the fruit exported. Thus the fine qualities of Palestine oranges and grape-fruit are being brought to the notice of people in the principal fruit-consuming countries of Europe. The cost of this inspection service and the administration of the propaganda fund is being borne by the shippers themselves, and not by the Government.



Gathering Jaffa oranges. The fruit is clipped off and care is taken to avoid scratching the skin, which would lead to decay.

While these various schemes for quicker transport, an inspection of the fruit before shipment, and large-scale advertising campaigns may do much to increase the demand for the fruit, the shippers realise that it is doubtful if they can attain their aim of an export trade of 20 million cases unless they are prepared to accept lower prices. The cheaper they can sell their fruit the more will consumption be increased. Thus they are demanding through the Colonial Office and the British Parliament the grant of Imperial Preference—the same treatment as is meted out to the growers of South Africa and Australia. At present the fruit is subject to a Customs duty of about 3s. 6d. a box on grape-fruit and 1s. a box on oranges. The growers declare that their profits are small, only 4s. a box on grape-fruit and about 3s. a box on oranges. A reduction in the duty, or its abolition would enable them to place the fruit on the market more cheaply, to the benefit of the people of this country as well as the growers. At present this country takes 70 per cent. of the oranges and grape-fruit that are grown in Palestine.

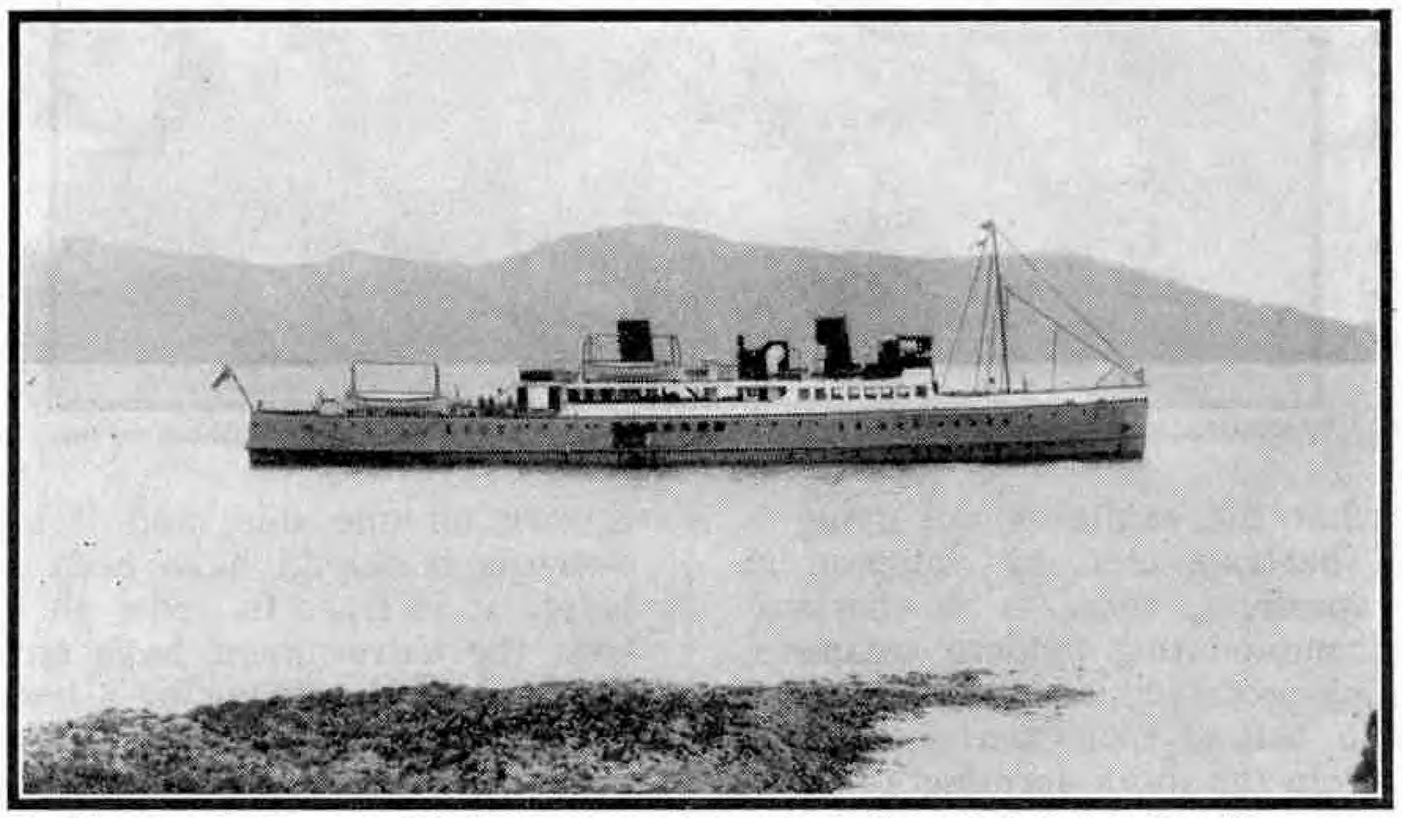
# The Magic of the Firth of Clyde

## Glasgow to Ardrishaig by the "*Lochfyne*"

By O. S. Nock, B.Sc., D.I.C.

AN early morning start to any journey always gives an indefinable though quite definite sense of adventure; there is a nip in the air, and a feeling of elation. On going aboard the "*Lochfyne*" at 7 a.m. this feeling rises to a tremendous thrill of expectancy, for this stout little craft makes her daily voyage among high mountains, by firth and sea loch, carrying the Royal Mail to some of the remotest parts of the West Highlands. The scene at Bridge Wharf, in the heart of Glasgow, irresistibly fascinating as it is, gives not the slightest idea of the enchanting seascapes to which this rather grimy river leads; but one of the greatest charms of this voyage is that of infinite surprise.

From the wharf on the opposite bank sail the Burns and Laird Line ships to Belfast; immediately beyond the Clyde bridge is the massive viaduct carrying the L.M.S. Railway into the Central station, and at this hour train after train is arriving with hundreds of city workers. The morning is as yet grey, but away to the west a broad rift of clear pale green sky gives a hint of brighter weather to come. There is just time for a look round the engine rooms before starting; this is as well, because throughout the voyage the passing scene is of such compelling interest that to go below at any time would be to miss much.



The "Lochfyne," a Diesel-electric ship of 754 tons that carries the Royal Mail in winter from Glasgow, or Greenock, to Ardrishaig. Photograph by courtesy of David MacBrayne Ltd.

The "*Lochfyne*" is only a small vessel, with a gross tonnage of 754; she was specially designed for the summer service from Oban round the Isle of Mull to Staffa and Iona, but during the winter months she works on the Royal Mail route from Glasgow, or Greenock, to Ardrishaig. She is a Diesel-electric ship of about 1,600 h.p. To enable passengers and mails to be landed at short jetties at all states of the tide, and shallow waters navigated at full speed, she has been designed with a very shallow draught, and so the engine room control platform is level with the lower saloon deck instead of in the depths of the ship. There are two 5-cylinder Diesel engines, and each of these drives an electric generator; the latter have an output of about 750 amperes each, direct current, at 500 volts. Each of these dynamos supplies current to an electric motor that is directly coupled to one of the propeller shafts. Throughout a voyage the Diesel engines are kept constantly running so that full power is available at a second's notice. All that has to be done on receiving the signal from the bridge is to switch on the motors, an operation that is rather like starting up an electric train, except that with a ship you can put on full power immediately.



Loading the mails at Prince's Pier, Greenock.

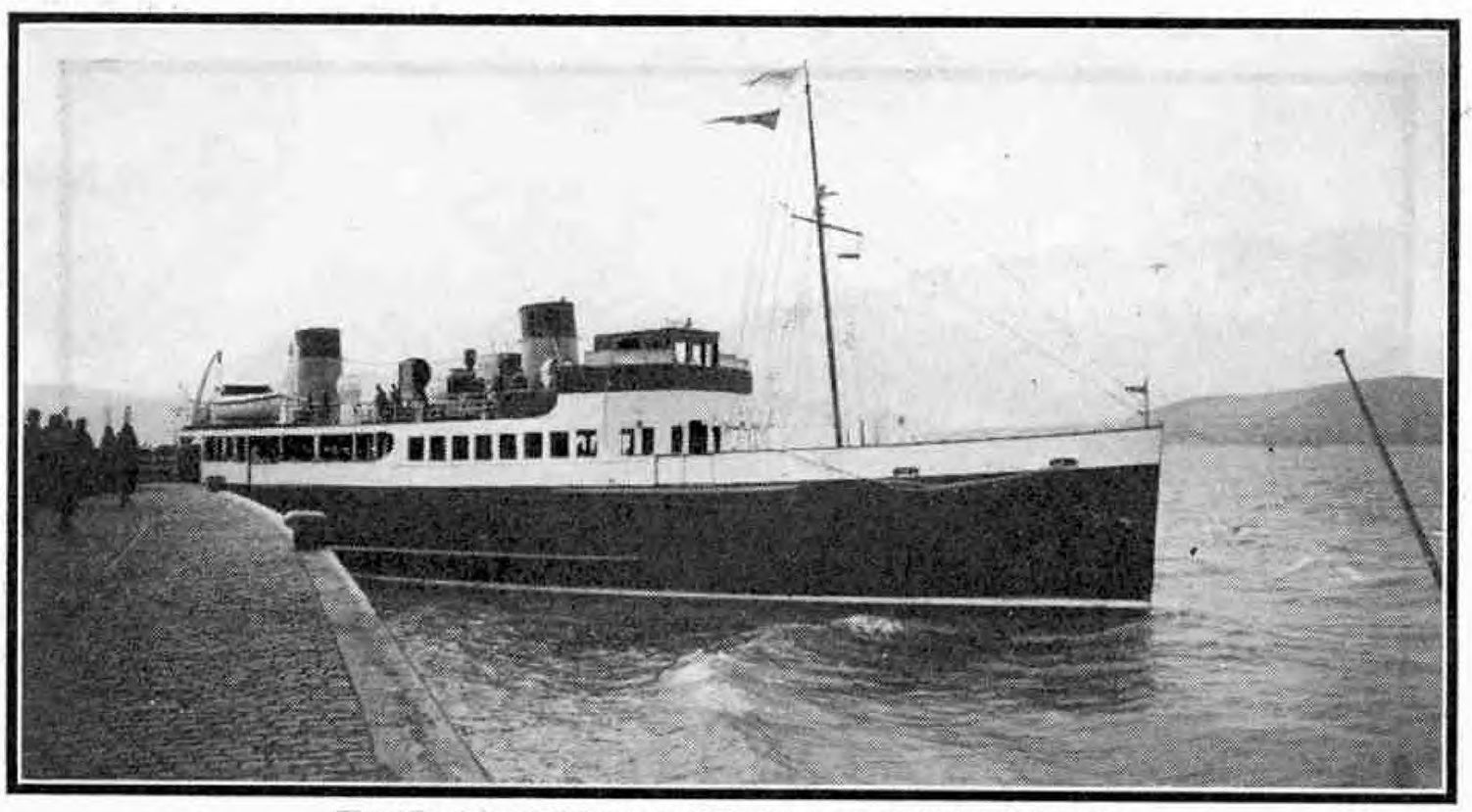
The "*Lochfyne*" sails at 7.11 a.m.; that odd minute seems very curious, but so it has been for very many years, in fact the 7.11 a.m. departure of the Ardrishaig mail boat is quite one of the traditions of Glasgow. Just before starting time I was welcomed on the bridge by Captain Cameron, and a moment or so later the gangways were let down and we were under way. The first miles lead past a score of shipyards, vast warehouses, and docks to which come ships from the very ends of the earth. On the stocks at such famous yards as Barclay Curle's, the Fairfield Engineering Company, and Harland and Wolff's were to be seen vessels of all kinds: cruisers, huge Diesel-driven merchantmen, motor yachts. At some yards there were three or even four ships under construction, some nearly ready for launching, others scarcely advanced beyond the laying of the keel.

The Clyde is an amazing river. Past all these shipyards it is so narrow that even small vessels have to be launched into it slantwise to avoid hitting the opposite bank, and it can usually provide something in the way of vivid contrasts. Near Govan, where we called at the little pier to pick up passengers, a great 25,000 ton Anchor liner, the "*Transylvania*," was berthed alongside one of the quays, while just ahead one of the gaunt vehicle-carrying ferries nosed its way across; these queer-looking craft are provided with a hoist so that the platform can always be brought level with the landing berths at any state of the tide. If the ferries are gaunt looking, even more so are the dredgers. The most remarkable thing about the Clyde is that by Nature it was anything but an ideal place to build ships, and in order to do so it has been artificially deepened and requires constant dredging. Between Glasgow and Dumbarton it is indeed more an excavation than a river. The dredgers are extraordinary looking implements—you could hardly call them ships! What passes as their deck is only a few feet above water level; two immensely tall funnels, placed abreast, rise from the stern, and on deck is what looks like a very thick-set version of a colliery winding wheel, up to which leads an endless chain of buckets. It is, thanks to the efficiency of such as these, that a vessel of the "*Queen Mary's*" size could be brought down the river successfully.

By the time we were approaching Clydebank, the birthplace of that beautiful ship, there was open meadow land on the south bank; the town of Renfrew slipped by, and to the north, behind the array of electric cranes at John Brown's yard, rose the Kilpatrick Hills, dark and solemn in the grey morning light. At Clydebank the river is considerably wider than nearer Glasgow, and right opposite is the mouth of the River Cart; but apart from this, the yard that has become world famous is little different from the others. At the

time of my trip the light cruiser *"Southampton"* was in the fitting-out basin. Below this point the river winds considerably; round the S-curve at Bowling even the *"Lochfyne"* was reduced to half-speed, although of course it was low tide, and so we entered the long straight channel that leads past Dumbarton.

Far ahead the sky was now brilliant, but a slight mist hung over the widening firth and gave Dumbarton's isolated rock the appearance of a big cone-shaped island. Along this straight stretch artificial banks have been built on each side of the deep water channel and on these are fixed the gas buoys marking the course; at low tide the banks are exposed. As we passed abreast of Dumbarton there was a glimpse, through a gap in the hills, of Ben Lomond away to the north, his snow-capped summit sparkling in the sun. Port Glasgow now lay on our port bow. There is an almost continuous chain of shipyards from here onward to Greenock, at one of which the ill-fated French liner *"Atlantique"* was waiting to be broken up. Seen against the dark hillside, her appearance at first sight was not unlike that of many another merchant ship needing overhaul; but as we drew closer her hollow interior, smashed and twisted bridge, and scorched metalwork gave a terribly vivid suggestion of the horror of fire at sea.



The "Lochfyne's" bows swinging out as she leaves Greenock.

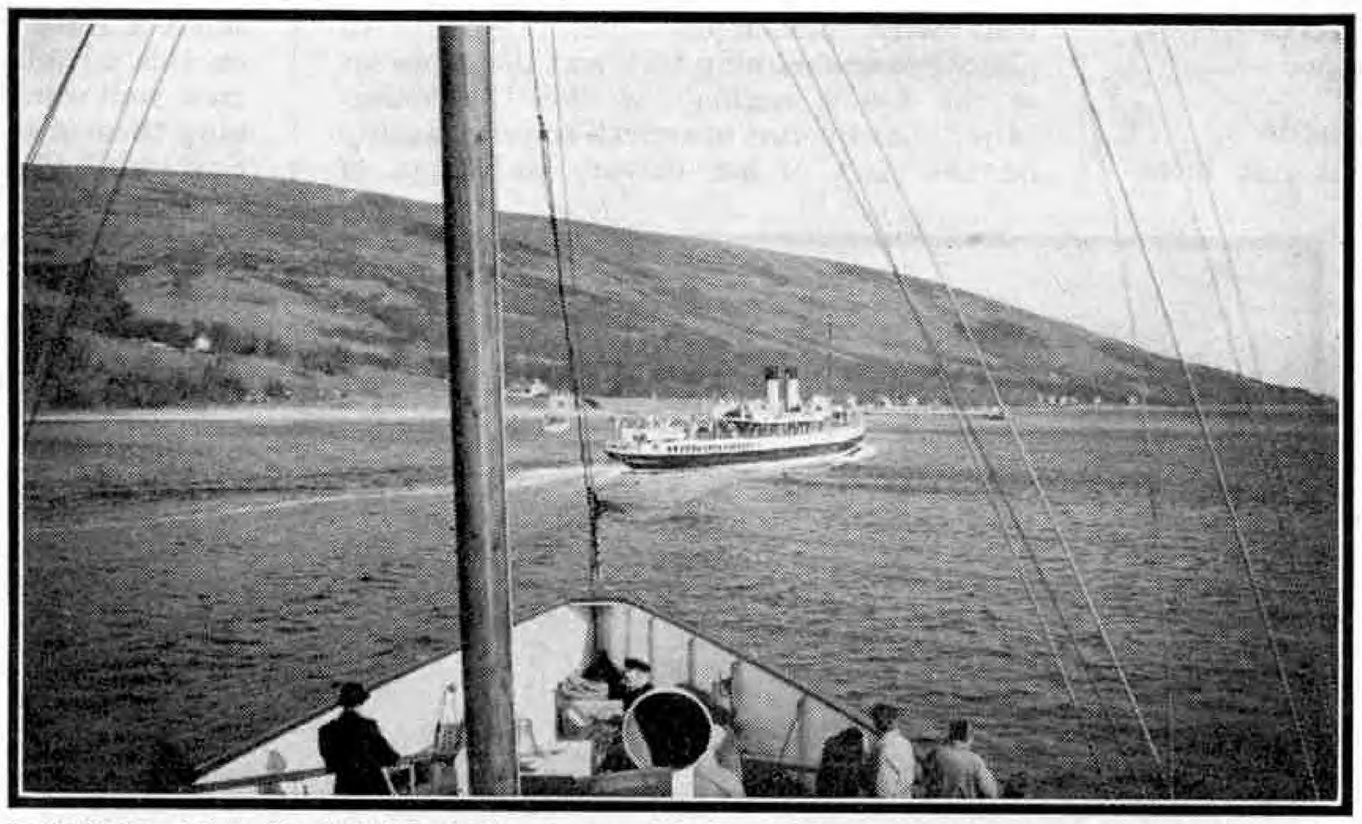
At 9 a.m. we were tying up at Prince's Pier, Greenock; here part of the mails is picked up, having come down from Glasgow by the G. and S.W. route of the L.M.S.R. Passengers who prefer to leave Glasgow as late as possible travel on the 8.35 a.m. train, via the Caledonian route, and join the ship at Gourock, where the bulk of the mails were taken on board. While we were at Gourock the changing lights on mountain and firth were of simply dazzling beauty; westward lay the Holy Loch, to the north was Loch Long, and just across the water near Helensburgh was the entrance to the Gare Loch. These inlets all point outward like the fingers of a human hand, and on the rolling hills between them shadows of the flying clouds were chasing each other over brilliantly green fields and purple-brown moorlands. Just astern of us at the pier was berthed another mail boat, bound for Lochgoilhead; this was the paddle steamer *"Mountaineer"* which, like the *"Lochfyne,"* belongs to the fleet of David Macbrayne Ltd.

At 9.30 a.m. the ropes were cast off once more and we headed for Dunoon. We were now almost exactly half way to Ardrishaig, but the difference between the two halves of the journey is a much more striking one than a mere matter of time and distance. Up to now the interest of the trip had lain chiefly in the engineering wonders of the Clyde; glimpses of distant peaks and occasional splashes of brilliant colour on the hillsides had given only the merest suggestion of the glory of the West Highlands. But now, half way between Gourock and Dunoon, with smoky Greenock disappearing behind Kempock Point, the last link with industry was severed, and at the same time, far away to the south, the wild jagged mountains of Arran rose blue from the sea. Range upon range of brown hills were grouped round the northern inlets of the firth, and from the gently rising moorlands of the Renfrewshire coast rose the smoke of heather fires.

Both the L.M.S.R. and the L.N.E.R. operate steamer services on the Clyde, and as we approached Dunoon there was a vessel of each company at the pier. This popular resort, together with Rothesay on the island of Bute, can only be reached by water, and during the busy months six or eight ships can often be counted at once plying the firth on various routes. We berthed at Dunoon to the skirl of the bagpipes. This music has to be heard in its natural setting of mountain and loch to be really appreciated, and this morning amid the splash of the water and the scream of seagulls, its wild air, borne on the wind, was thrilling beyond description.

Southward bound now the green hills of Bute came into view, the island of Great Cumbrae lay out in the firth, and far down the eastern shore the sun was dazzingly reflected from a skylight in Largs. We called at Innellan, where solemn crags and pine woods rose from the water's edge; and then, rounding Toward Point with its gleaming white lighthouse, we entered Rothesay Bay. Here is a fair-sized town most charmingly situated round the sweep of the bay; its pier resembles a busy railway station, at which no less than five steamers can be berthed at once. In getting away from all these piers the forward ropes were cast off first and the engine driving the propeller farthest from the pier was put at "Full Astern," while the near engine was usually put at "Half Ahead." This swings the bow away from the quayside, and as soon as the vessel is pointing well clear the after ropes are cast off and both engines put ahead.

From Rothesay our course is due north at first, and right ahead of us is Loch Striven, a narrow fiord winding far into the mountains; but on passing abeam of Ardmaleish Point we swung north-west into the Kyles of Bute. The waterway here is never more than half a mile wide. On the hills rising smoothly to the heights of Beinn Bhreac the colour gradually deepened from brilliant green at the water's edge to the deep rich brown of heather in winter, as the summits were neared. Ahead, moorland fires spread a soft haze, while firth and sky were of a truly exotic blue. At the little pier of Colintraive we landed some mails, and on setting forth again we were soon threading our way through the Narrows. Beyond this point, although the Kyle widens considerably, there are two rocky islets, known as the Burnt Islands, that reduce the navigable waterway to two channels barely 100 yards wide.

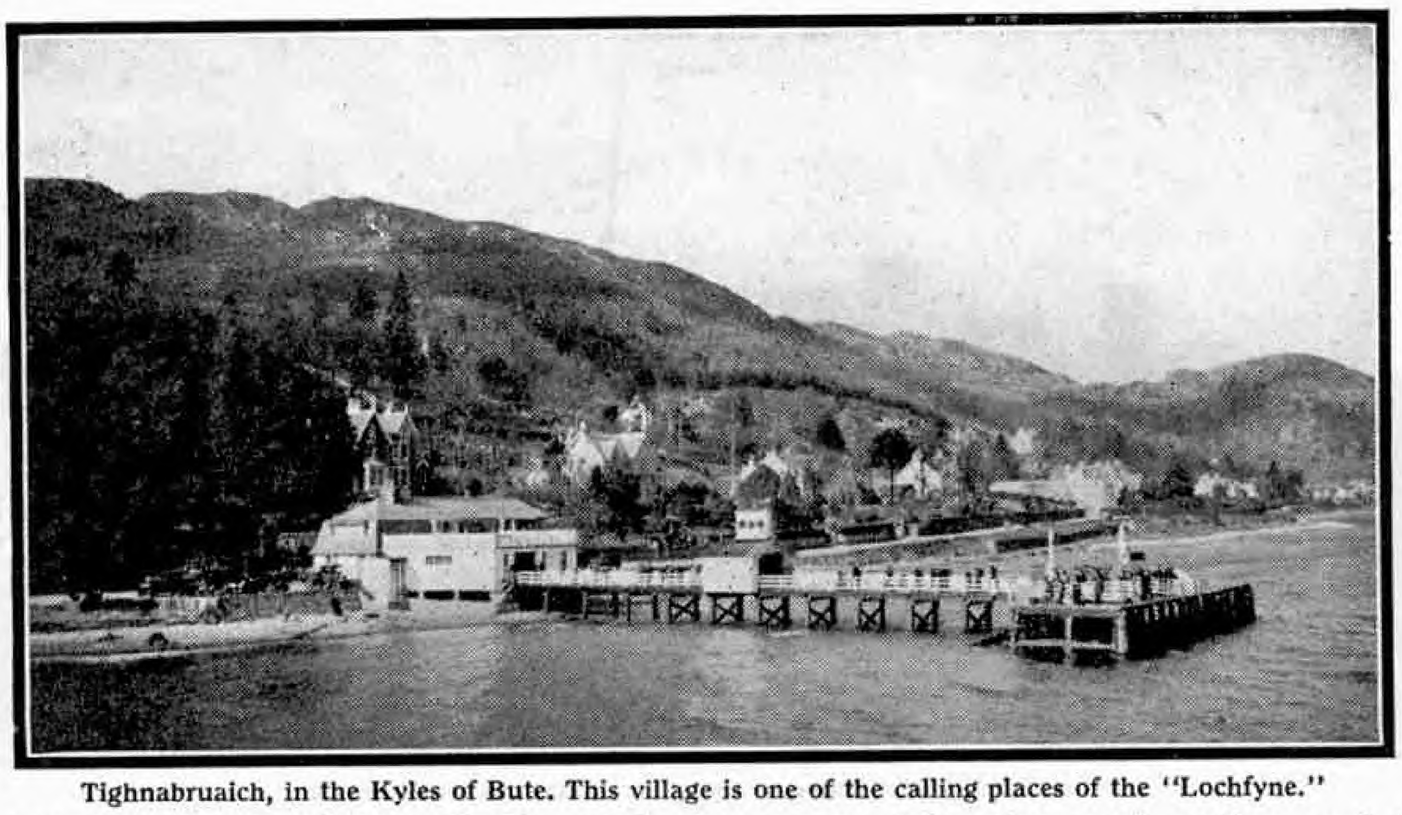


In the Kyles of Bute. The L.M.S.R. turbine steamer "Duchess of Argyll" is passing ahead of the "Lochfyne."

Ahead now was a wall of great beetling crags, and leaving Loch Riddon on our right we turned southward into the western arm of the Kyles of Bute. At the turn the character of the scene changes entirely: smiling farm land at the waterside gives place to rugged outcrops of bare rock, and instead of smooth rounded hill tops there are rough overhanging crags. As if to harmonise with the wilder scene great clouds were racing across the sky, the rising wind whipped the sea into a welter of white caps and there was every sign of an approaching squall. Just beyond the narrowest part of the western Kyle is Tighnabruaich, an exquisitely pretty village of white cottages and trim villas straggling up the hillside. We called here at 11 o'clock, and then set out on our longest non-stop run since the Govan-Greenock stage,

the enjoyable passage that brought us to Tarbert.

The Kyle widened out into the Sound of Bute, once again Arran loomed ahead, much nearer now, but a mass of cloud clung round its highest peaks and gave the whole island the appearance of a vast grey shadow. The land on our starboard side gradually tapered down to Ardlamont Point, and soon we were turning a complete half-circle round this promontory and heading up Loch Fyne. Looking north now the prospect was majestic in the extreme. Overhead were range upon range of cumulo-nimbus clouds separated by patches of the most intense blue, and beneath the loch was the colour of steel; the hills to the west were deep in shadow while the eastern shore was bathed in brilliant sunshine. In the early spring the lower hillsides are often of the palest yellow that in company with sea and sky produces some enchanting pictures.



Tighnabruaich, in the Kyles of Bute. This village is one of the calling places of the "Lochfyne."

The "*Lochfyne*" is now bearing towards the western shore of the sea loch after which she is named, and soon the little inlet of East Loch Tarbert can be distinguished against the dark hillside. "Tarbert" is a Gaelic word meaning an inlet of the sea, and there must be dozens of villages with the same name along the west coast of Scotland. At this Tarbert the long peninsula of Kintyre is almost cut into an island, for the two inlets, West Loch Tarbert from the Atlantic, and East Loch Tarbert from Loch Fyne, almost meet. The eastern loch is very pretty; it is fringed with trees and there is a noble background of hills. We reached the pier just after noon. There we found a motor coach was waiting, bound for Campbeltown near the southern end of the peninsula of Kintyre and nearly 50 miles away, and a large quantity of mails were put ashore, the bulk of them being for the islands of Jura and Islay, for the Campbeltown mails are taken direct by steamer. Passengers for Islay and Jura are taken by coach as far as West Loch Tarbert, and from there the steamer sails, reaching Islay about 4.30 p.m.

As we got away from Tarbert a squall swept across Loch Fyne, veiling the mountains in a curtain of rain; but in a very few minutes blue sky could be seen through the driving grey shroud, and the hills of Cowal on the eastern shore were in sunshine. Of all the phenomena produced by the weather in the West Highlands none is more beautiful than the clearing of a heavy shower of rain, and now, sailing up Loch Fyne, it was seen to perfection. The waters gradually changed colour from lead, through deep green, to the most vivid ultramarine, and the sunshine on the distant hills gave to their rich browns a purple tinge as of heather in bloom.

The village of Ardrishaig could now be distinguished some miles away up the western shore. The upper reaches of Loch Fyne wind far away into the hills for nearly 30 miles, beyond Inveraray, and to within 10 miles of the head of Loch Long. We were heading for the small inlet of Loch Gilp. Until quite recently the service from Glasgow to Oban was operated through the Crinan Canal, a short waterway that cuts across the isthmus from Lochgilphead to Crinan; a special steamer was used for the canal section, and then at Crinan passengers transferred to one of Macbrayne's well-known two-funnelled paddle boats. By far and away the most famous of these was the "*Columba*," which worked on the Glasgow-Ardrishaig run for over 50 years and was described and illustrated on page 308 of the "*M.M.*" for May; the "*Chevalier*" was usually employed on the Crinan-Oban Service. Nowadays the whole journey from Ardrishaig to Oban is made by motor coach all the year round, by a delightful Highland road that is never far from the sea.

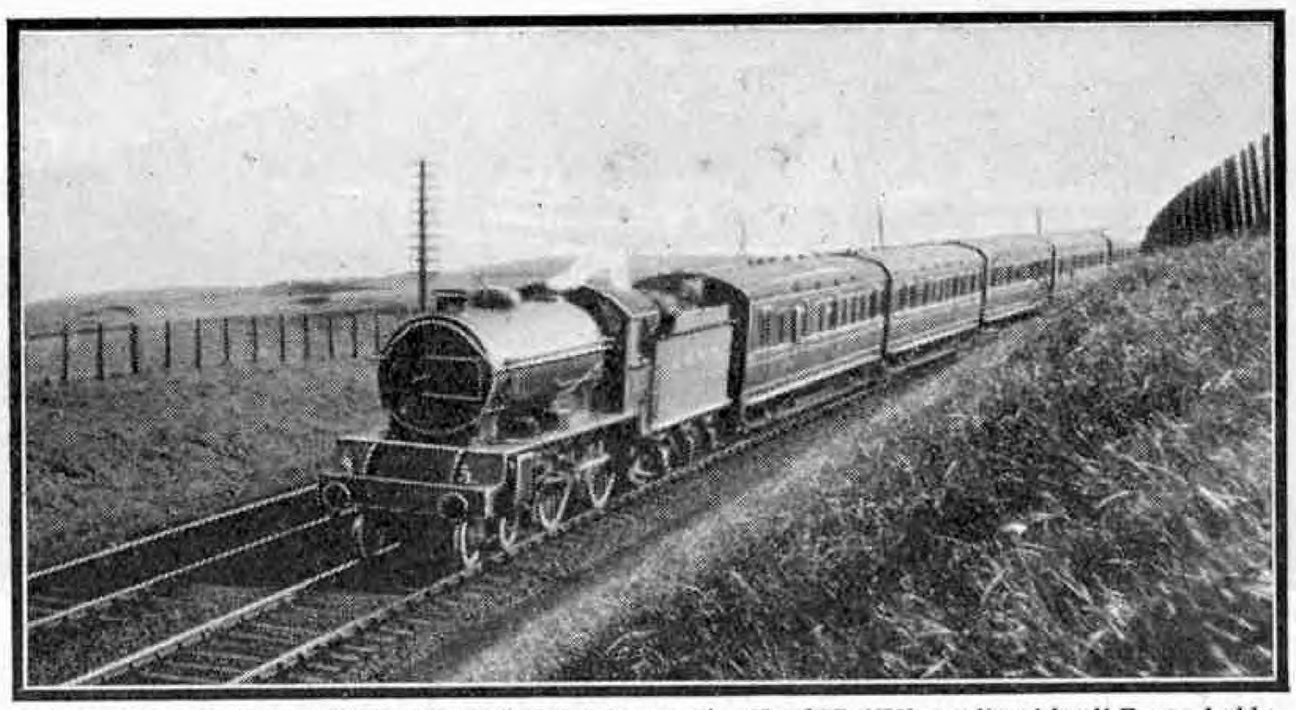
By now the little stone jetty of Ardrishaig with its lighthouse is at hand, there is great bustle on the wooden pier inside the harbour in anticipation of our arrival, and in just under six hours from Glasgow we are alongside and tying up. And so at this typical West Highland village, with its stone cottages straggling along the water's edge and the hills of Knapdale rising behind, ends one of the most enthralling voyages in Britain.

## A Remarkable L.N.E.R. 4-4-0 Performance

**By a Railway Engineer**

At busy holiday seasons it not infrequently happens that engines of quite moderate power are called upon to perform first class express duty. Such a case occurred on the Thursday before Easter this year when the L.N.E.R. 1.20 p.m. "*Scotsman*" was run in five portions; the regular express, working to the ordinary schedule, had been preceded by four reliefs. The engine provided to work the fifth part forward from Newcastle was not a "Pacific," nor yet an N.E. "Atlantic," but a 3-cylinder 4–4–0 of the "Shire" class.

The 1.20 p.m. is by far the hardest train of the day between Newcastle and Edinburgh, being allowed 147 minutes to cover the 124½ miles, inclusive of two regular stops and two conditional stops that are usually made. To run the 57½ miles from Berwick to Edinburgh in 67 minutes, with two stops, is a stiff proposition with the normal load of 300-340 tons, even with a "Pacific" at the head of the train; but on Maundy Thursday last the load was no less than 412 tons tare, and 435 tons with passengers and luggage. An almost overwhelming task was therefore set to the 4–4–0 engine No. 249 "*Aberdeenshire*," but by dint of superb enginemanship on the part of her driver, McKellop, of Haymarket shed, Edinburgh, the loss of time was amazingly small.



An Aberdeen express hauled by L.N.E.R. 4-4-0 locomotive No. 307, "Kincardineshire." Remarkable work by a similar engine is described in the accompanying article.

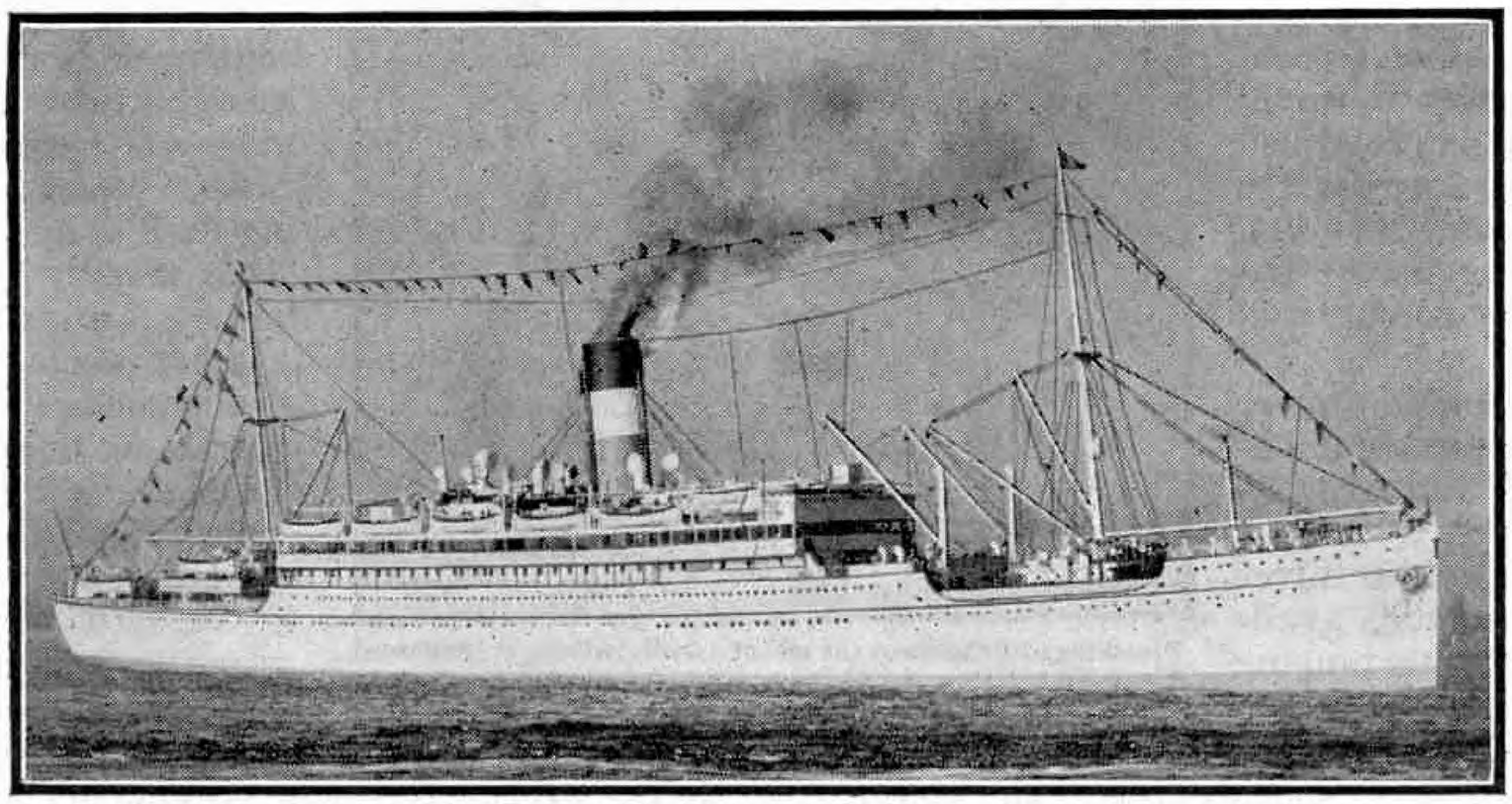
Getting away very smartly from Newcastle and sustaining 37 m.p.h. up the 1 in 200 of Benton bank, some cautious running was needed past Annitsford owing to colliery subsidences. Speed was picked up well to 66 m.p.h. at Stannington and then came the severe slowing round Morpeth curve. A single minute was all that had been dropped on this initial section and with engine and crew well warmed up to their work the running thenceforward was really magnificent. Sustaining 60 to 67 m.p.h. throughout the undulating stretch that succeeds the Morpeth slack, No. 249 reached Alnmouth, 34.8 miles, in 43 minutes, or 42 minutes net, a loss of only a minute on schedule.

On the next stage time was kept almost to the second. Starting up the formidable Longhoughton bank, 4½ miles at 1 in 170, the engine accelerated all the way up and breasted the summit at 35 m.p.h.; then a glorious dash for Berwick followed. Speed rose to 77 m.p.h. at Beal; for 17.8 miles from Christon Bank to Goswick the average was 68.1 m.p.h., and, most brilliant of all, the 4½-mile bank at 1 in 190 past Scremerston was mounted at a minimum speed of 54 m.p.h. So Berwick-on-Tweed, 32.1 miles from Alnmouth, was reached in 36 minutes. Up the 1 in 200 to Grant's House 46½ m.p.h. was sustained—a feat involving an output of 1,500 h.p.—but although 80½ m.p.h. was touched down Cockburnspath Bank time was lost to Dunbar. The last 17.8 miles, from Drem into Edinburgh, were completed in 24½ minutes.

# Seeing the World

## Cruising Holidays in Great Liners

ONE of the most cheerful scenes in the world can be seen when a cruising ship is about to leave her home port, carrying with her a happy crowd of holiday makers. The vessels usually are gaily decorated with bunting, and their white hulls glisten in the sunshine, as in our illustration of the *"Vandyck,"* of Lamport and Holt Ltd., in the Mersey. This vessel and the *"Voltaire"* are sister ships of 13,200 tons, and their blue funnels with black tops immediately above a white band are familiar to all who know Merseyside or Southampton. The long list of ships now engaged in similar work includes representatives of many famous lines, among them the *"Franconia"* and other vessels of the Cunard White Star fleet that were intended originally chiefly for the North Atlantic service, and have been diverted to this newer form of holiday traffic.



A gaily-bedecked cruising steamer in the Mersey. The vessel is the "Vandyck" of the Lamport and Holt Line. Photograph by B. and A. Feilden, Blundellsands, Liverpool 23.

Formerly holidays by sea were almost entirely confined to those fortunate people who had at their disposal an ample supply of time and money. To-day wonderful opportunities of sea cruising are open to people of quite moderate means and who have only a few weeks or even a few days to spare.

It is rather curious to reflect that this new phase of short pleasure excursions by sea came about as the result of the depression in the shipping world a few years ago. Many fine liners had to be withdrawn from their usual services simply because there were not enough passengers for them to carry. As an alternative to laying up their vessels certain shipowners decided to experiment with short cruises, and the result was immediately and quite surprisingly successful. As is usually the case when any new scheme is brought forward, the croakers said that this kind of cruising was only a passing craze and would not last. Time has proved them wrong, however, and there is no doubt that the short cruise has come to stay, for the very good reason that it meets a genuine public demand. The shipping companies have spared no efforts to meet the requirements of this new class of ocean traveller, and their enterprise has been well repaid.

It is not difficult to understand why this new form of holiday should have become so popular. In the first place a cruise provides perhaps the easiest of all ways of taking a holiday. Once the ticket is bought there is absolutely nothing else to worry about. The ship is at one and the same time the means of locomotion and the hotel. At the various ports of call excursions are arranged, and there is nothing to do but step into the conveyance provided and revel in the new and strange scenes of a foreign port. While the ship is at sea sports and games of all kinds are arranged, and there is not a dull minute. Those who are full of energy can be active all day long; those who are fat and lazy can simply revel in doing nothing but drowse in the sunshine. To all alike comes the wonderful tonic effect of a holiday that is a complete change in every respect from normal every-day life.

It is quite astonishing to find how many countries can be visited in the course of quite a short cruise. Whatever the holidaymaker wishes to see, from the northern capitals of Europe and even the Arctic wastes of Spitzbergen to sub-tropical Northern Africa, is open to him. He can visit Portugal or sunny Spain and explore the Mediterranean Sea, or travel farther south to Morocco, Madeira or the Canary Islands.

The islands in the Atlantic Ocean off the African coast are indeed favourite ports of call for cruising steamers, particularly Grand Canary, one of the Canary Islands. There Nature has been lavishly generous, and the island is remarkable for the magnificent scenic effects of its formidable heights and its black volcanic gorges in which vineyards abound. Excursions amid its ravines and mountain slopes combine with visits to its beaches, carpeted with the finest white sand, to add to the pleasures of a cruise; and these are heightened by the pure and bracing air and mild equable temperature that has made the Atlantic islands famous health resorts.

It is not necessary to leave the British Isles in order to enjoy a holiday of this kind, and nothing could be more pleasant than to cruise among the mountains, lochs and islands of the West Coast of Scotland. The full beauty of the firths of that famous holiday region can best be appreciated from a deck of a steamer sailing into them, and to see them in this manner is one of the most delightful ways of spending a holiday. The ship calls at various places, at which interesting shore excursions are arranged.

Cruising indeed provides a magic carpet.

# The World's Queerest Jobs

## Achieving Realism on the Cinema Screen

By Andrew R. Boone

IN Hollywood there are more sane people performing crazy jobs than anywhere else in the world. No job is too "queer" for the workers behind the scenes in the city of celluloid, for the demands of the camera and microphone are many and varied. For instance, take horses' tails. Harold Lloyd selected a fine sorrel mare to pull his wagon in *"The Milky Way,"* but the cameraman soon registered a protest. Cameraman, director and owner of the animal conferred, and half an hour later Jerry Smith found himself busy making the tail blonde with the aid of a paint spray gun in order that it would register more clearly as it swished backward and forward across the actor's face. Thus was a new job added to the growing list of the cinema's already large number of unusual pursuits.

Occupations that would be queer in the average town are commonplace in Hollywood and Elstree. At the former, 500 men and women are listed in studio directories as owners of animals available for pictures at rentals ranging from £1 to £30 a day. There also are men who will catch anything that lives in Southern California on short notice and deliver their victims, alive and kicking, to any studio—for a price.



Bleaching cattle bones on the roof of a studio building in Hollywood. These bones were required for a picture introducing desert scenes in the wild west.

Not long ago a studio demanded delivery within 48 hours of 320 grasshoppers, 225 large red roaches, 430 spiders, 60 small roaches and 25 black beetles. The firm receiving the request devised ways and means of filling the order. Five experienced men took to the fields near Los Angeles and netted the grasshoppers during a two-day chase. Spiders were plucked from thick hedges. The basement of a large office building gave up the cockroaches, but only after a crew of men had moved scores of barrels and boxes.

"This," declared one of the men engaged in the task, "was the craziest order we ever got. Well, nearly the craziest. Sometimes a studio wants someone to be bitten by a rattler. For £10 a bite, I'll let 'em strike. When they're cold, they don't really bite. Anyway, I wear boots. So it's easy money."

The story is told in Hollywood of an Italian organ grinder with three monkeys who had come to the United States hoping to eke out a livelihood. One day a director saw him in a side street, hired him with his three monkeys for a picture, and thereafter for seven years the Italian worked the little creatures regularly. Though he had trained them to perform only simple tricks, the monkeys drew larger pay than their owner, for every day they worked each earned £5, while the Italian only received £2. After seven years the organ grinder retired to Italy, having saved enough from his earnings to retire.

When I toured Hollywood recently to seek out the world's queerest jobs, and to talk with the men who perform these unusual tasks, I found a score of them earning their daily bread at things that seem silly, but have very definite values. For instance, on the roof of a great stage at the Paramount studio I discovered Fritz Dickie examining the bleached bones of a dozen steers killed a few weeks previously. It is Dickie's job to collect old bones and bleach them for use in western pictures. For several years he made regular trips to the Southern California deserts seeking old bones, but the desert no longer takes its historic toll of cattle, so now he obtains his bones from slaughter houses, and does his own bleaching.



Spraying flowers with dyes to give good photographic colours.

Then there is the squeak eliminator. This is not a mechanical device, but a carpenter in the person of Robert Green. He ferrets out squeaks on each new set by pushing a roller over the floor. When he finds one, out come his hammer and nails, and he kills it before some actor releases the noise. Green has found and destroyed hundreds of squeaks, any one of which might have cost a month's wages in lost time and spoiled film if it had been heard and recorded while a part of a picture was actually being "shot."

All glass used on a motion picture set must be invisible, for otherwise the camera will pick up reflections and register the dirt. Not long ago an actress walked through a plate glass show window and fractured her nose. Immediately, Charles Beauchamp got a new job, and on every set involving the use of glass, it is now his duty to stretch strips of black tape in the form of crosses over all glass until the camera begins to turn.

No further glass accidents have been reported in that studio.

"Mirror spoiler" is the unusual assignment given William Witt whenever his studio films a picture requiring their use on the set, and with good reason, for no matter how carefully mirrors may be placed, they pick up light and reflect it into the camera. On the set a mirror usually need only look like one, and Witt therefore coats them all with a thin layer of liquid wax in order to stop this unwanted reflection.

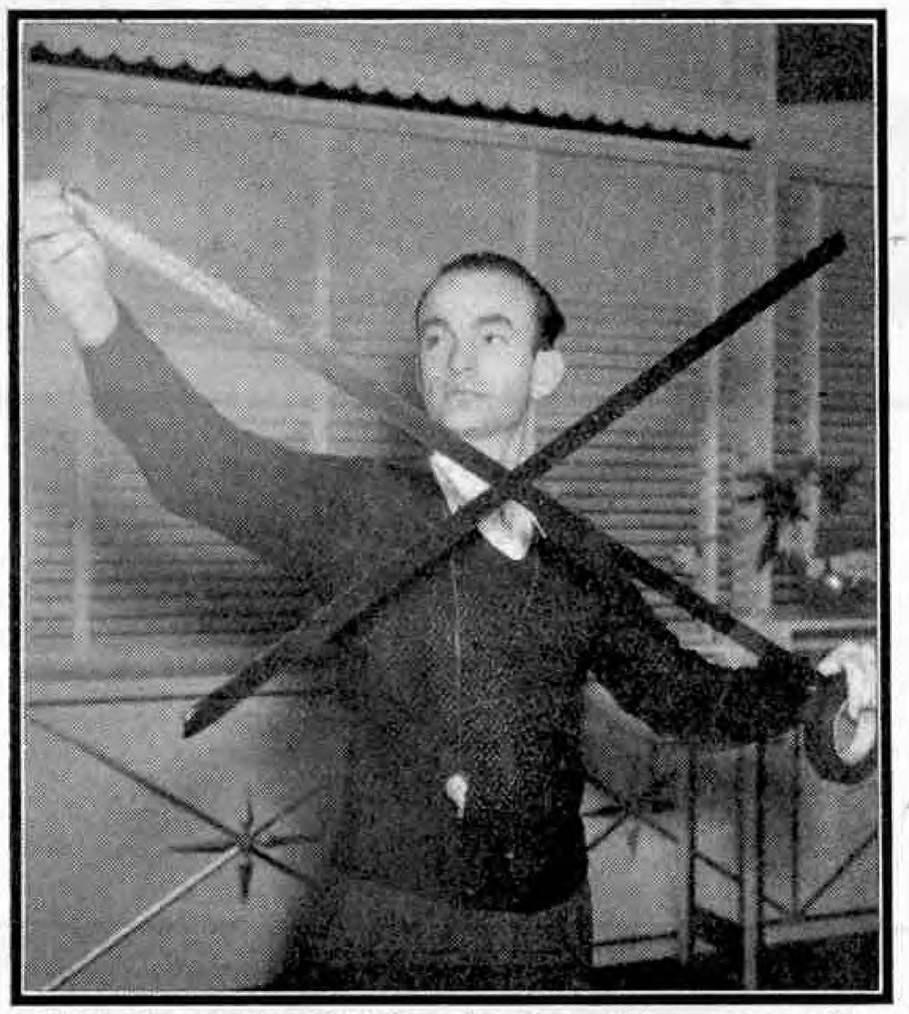
While it is one man's job to save property from damage, it is another's to wreck things artistically and well. Arthur Camp breaks crockery and statuary so effectively that whenever a scene is shot in which a fight or storm supposedly has taken place, he is called upon to smash a score or more plates, statues and vases to small bits. Scattered around the set these fragments add to the appearance of confusion.

Everything appearing in a set representing an old English street, with houses built 100 years ago, or an old house, must be given the appearance of age. Carpenters, equipped with blow torches, grey paint and lampblack, burn off fresh paint and "dirty" the walls. When the set itself has been aged, property men bring in the smaller articles, such as chairs and pictures. These, too, must give the appearance of long, continuous use, and this is the special task of Pat Delaney, who with his dark shellac and an assortment of paints has made more small objects look old than any other Hollywood property man. Delaney learned his job while reproducing antique furniture.

Suppose the director of a picture calls for a spider web-infested haunted house. After the agers have done their work and departed from the set, in walks a man spider to spin the web. Harry Thompson recently devised a novel machine with which he can fill a large room with interlaced webs in 10 minutes. This consists of an electric fan, with a container of liquid rubber fitted directly in front of the blades. Centrifugal force spins the rubber into a tiny thread, and the air current blows it out. Recently Thompson walked through 10 rooms and halls of a large set in which scenes of the picture *"Seven Keys to Baldpate"* were being filmed, and there spun an intricate web containing hundreds of yards of rubber more quickly than a spider can spin two feet of its fragile product.

It is the ambition of every director to see his picture and name on the screen, and every actor wishes his face to be shown registering comedy and tragedy in all the picture houses of the land. Yet there is in Hollywood one man who has directed thousands of pictures, not one foot of which ever reached the public; and there are several score actors, all busily at work, who have never appeared in any scene shot by the cameras.

The man who has filmed so many scenes that have never been exhibited is a test director, and from the beginning his work is destined for the scrap heap. To him come the principal players of pictures produced by the studio where he is employed, and he tests them to make sure that their make-up is of the proper colour and tone, and is properly applied; that they have selected suitable costumes; and that they read their lines in accord with the "mood" selected for each character. Those who "pass" are selected at high salaries for the picture, and a few weeks later the test film is discarded.

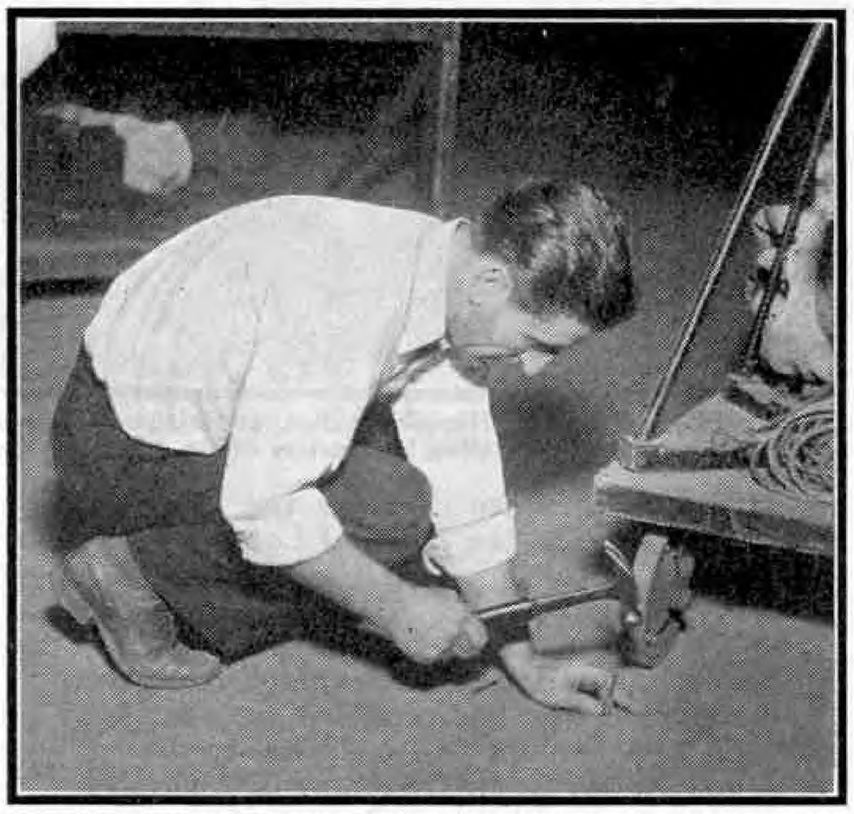


A screen actress once walked through a glass window on the set. Now black tape is pasted over windows until the scenes are "shot."

The actors never seen on the screen are known as "stand-ins." They are men and women chosen because each resembles some high-salaried star in size and features, and are paid moderate salaries for taking the places of their principals for long hours before the camera or while the cameraman studies angles and makes adjustments. At the last moment, when all is ready, the star, untired by these tedious preliminaries, appears and plays the scene.

A natural flower or blossom is seldom seen in a picture. Roy L. Hollis specialises in creating beautiful artificial flowers and trees, and these are made of lacquer, bamboo, copper and paper. Not long ago Hollis produced in a few days 10,000 branches of imitation peach blossoms, each consisting of wood-fibre flowers tied to natural wood, and he has been known to complete as many as 720,000 flowers and branches for a single movie production.

Because of the artistic appearance and long life of artificial flowers, less than one tenth of all seen on the screen are provided by nature. Many of the real flowers used do not photograph well in their natural colours, so at one studio Bill Tait not only keeps them fresh, but changes the colour to suit varying conditions of background and lighting. Using an ordinary spray gun and special dyes, Tait dyes roses blue, lilies purple or green, and performs other feats of magic while the camera waits.



The official squeak detector at work in a Hollywood studio. Nailing down squeaky floor boards keeps him fully employed.

Probably no studio worker has his ingenuity taxed more than the property man. He may be called upon one minute to supply an old champagne bottle, only to have the director follow this order with a demand for a cow bell. Irving Sindler, head property man at the Samuel Goldwyn studio, has developed several portable boxes which he keeps on the set near the cameras. From these he can produce anything from a doorbell to fog-making apparatus and pop guns.

These examples do not represent all the unusual pursuits behind the scenes at Hollywood, for there are many other experts who have similar strange tasks.



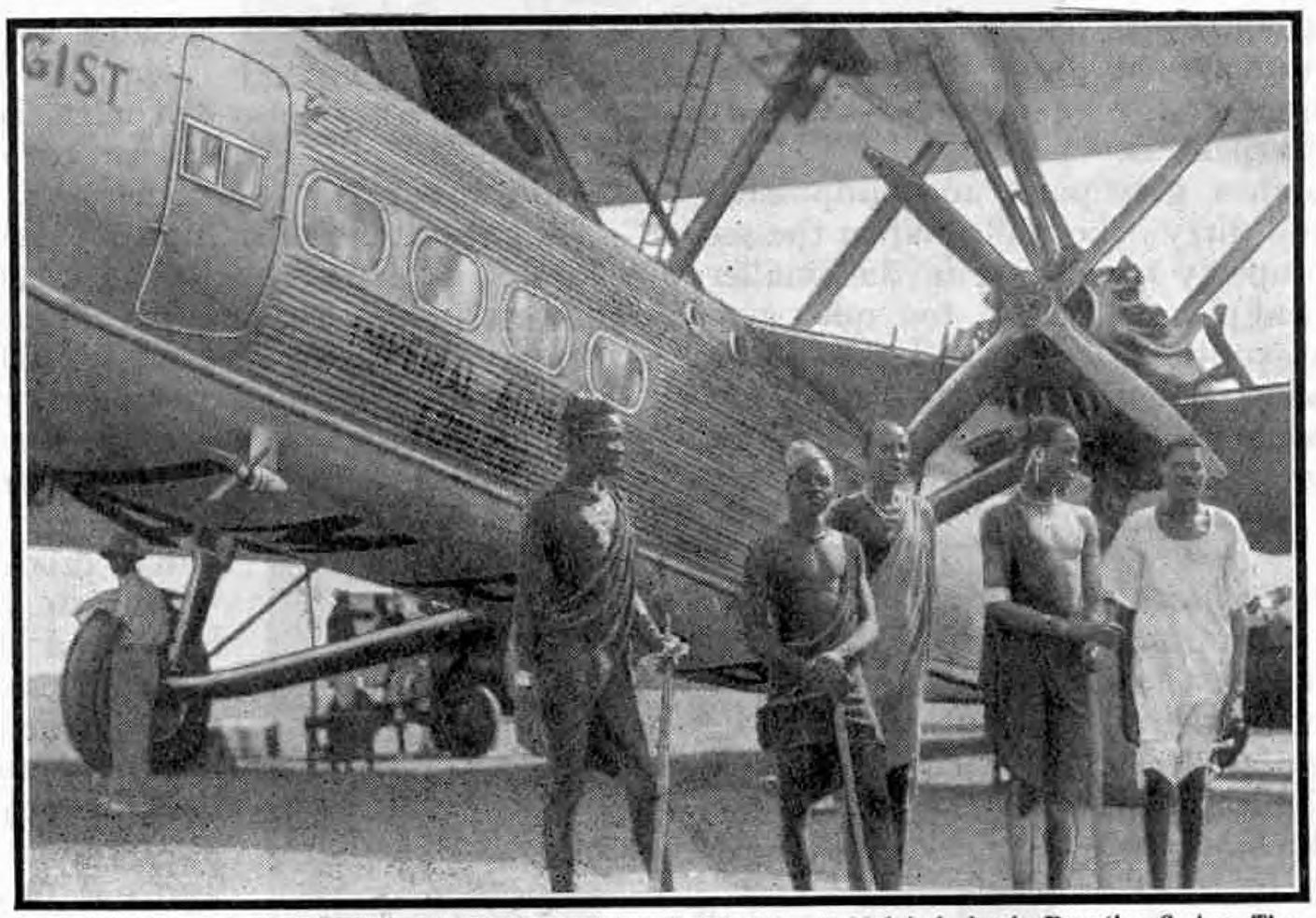

### A Day at Croydon Airport

Now that the summer services of the principal British and European air transport companies are in operation, more than 60 aircraft fly in and out of Croydon Airport daily. They include newspaper carriers, cargo craft, specially chartered machines, air liners to and from the Continent, services to and from destinations throughout the Empire, and fast air expresses of the British internal air lines.

In the early hours of the morning the aircraft that carry newspapers to the Continent are taking on board their loads and vanishing over the hills on their way to the coast. After this there are the departures of early-morning passenger aeroplanes for the Continent. A Dutch service leaves for Amsterdam; a big machine departs for Cologne; a French air-liner ascends for Paris; other services are signalled out to Brussels and Lille.

Here is one of the fast expresses of our inland airways, bound from London to Glasgow. Then come aircraft outward bound for Paris, Zurich, Rotterdam and Budapest. By the Imperial Airways express services one can now reach Budapest or Brindisi in a day's flying. Passengers outward bound across the Empire mingle with those who are about to make trips over the Continent. Every now and then a specially chartered aeroplane will leave on an urgent flight. So the day wears on—big motor coaches arriving with fresh parties of passengers, and mail vans dashing up with bags of letters to be air-borne throughout Europe or for thousands of miles across the Empire. Now the air liners of the outward bound evening services are departing, and presently, with a drone from its powerful engines, a big night freighter is winging its way from Croydon on its flight to Berlin.

All this outward traffic has its counterpart in a stream of inward bound aeroplanes. Early-morning arrivals at Croydon are from cities such as Amsterdam and Brussels; then comes a large air liner from Berlin, followed by one from Paris. Now an air express arrives from Glasgow, its passengers effecting connections with services that will carry them to destinations on the Continent. Other big machines reach Croydon at intervals from Switzerland, Sweden, and Budapest, and gliding down to the landing ground they taxi to the arrival platform. Airway porters are ready to handle the luggage; postal vans stand waiting for the mails; Customs and other officials are very busy. Speed is the watchword of the airway on the ground as well as in the air, and soon motor coaches are carrying the incoming passengers into the heart of London.




**Imperial Airways' air liner "Hengist," of the "Hannibal" class, at Malakal, Anglo-Egyptian Sudan. The natives are members of the Shiluk tribe. Illustration by courtesy of the American Colony Photographers.**

### Brisbane-Singapore Service Increased

The recent duplication of the Brisbane-Singapore section of the England-Australia Empire air line has provided two services each way weekly, and has already proved a great boon to air travellers in Australia. Residents in Western Queensland towns, for example, can travel by air to Brisbane, spend a day and a half in that city and then return home, all within three days. Before the advent of the air service the only link between Darwin and the South was a monthly steamer service. Australian business men can now fly to Singapore, spend 5½ days there and return to Brisbane in less than a fortnight. By sea a similar trip would take six weeks. Quantas Empire Airways Ltd., operate the Brisbane-Singapore air service.

### Isle of Man Air Races

The two Isle of Man air races were carried out in bad weather. The first one was the London–Isle of Man handicap race on Saturday 30th May, and only 12 of the 20 competitors who had entered for it made the flight. The race was won by Mr. A. Henshaw in a D.H. "Leopard Moth," second place was taken by Flying Officer C. F. Hughesdon in a Hawker "Tomtit," and third place by Mr. W. Humble, who flew a Miles "Hawk."

The second race was flown on Whit Monday, 1st June. It was also a handicap event, and consisted of three left-hand circuits of the Island, totalling 161.3 miles. The race began and finished at Ronaldsway aerodrome. A total of 18 machines were entered, and the race took place in continuous drizzle and cloud. It was won by Mr. R. F. Hall, who flew a Hillson "Praga," a new type of high wing cabin monoplane, Flying Officer A. E. Clouston and Flt. Lt. W. D. Guyler, in an "Aeronca" light aeroplane, finished second, and Mr. L. Lipton in a D.H. "Moth" was third.

### Airport for City of London

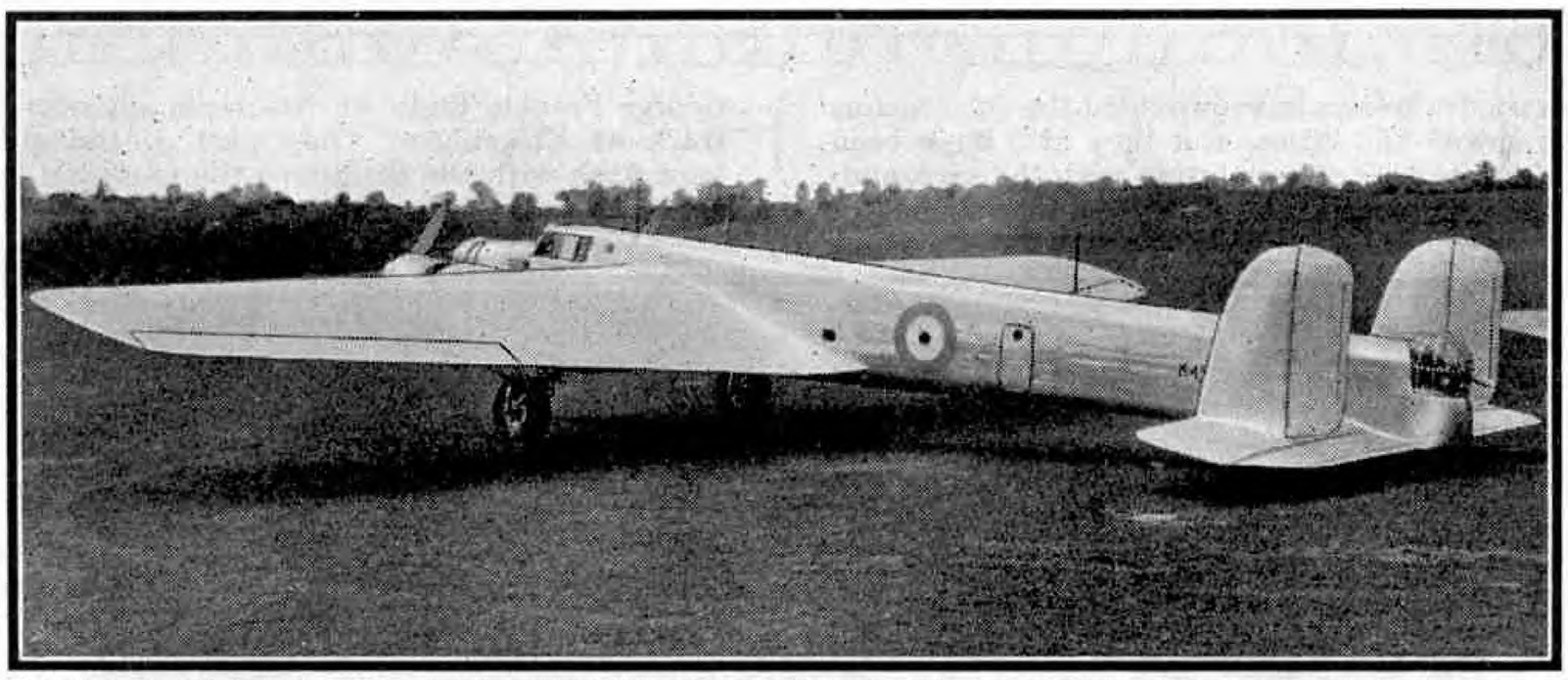
The City of London will shortly have its own airport, for its Corporation have decided to construct one at Fairlop, near Ilford, Essex. The site chosen is about 600 acres in extent, and it is estimated that the cost of buying the land and constructing the airport will be about £600,000. The work is to be put in hand immediately.

### Giant Aerial Camera

An aerial camera that is claimed to be the largest of its kind in the world has been produced by the Fairchild Aviation Corporation, of America. It has been designed specially for aerial survey work, and has nine lenses, the shutters of which are operated electrically. When the camera is used at a height of 30,000 ft. the lenses can photograph simultaneously an area of 600 sq. miles, and the record is obtained on one sheet of film. The camera weighs 305 lbs. when loaded.

### A New British Bomber

The upper illustration on this page shows the Armstrong Whitworth "Whitley," the latest British Bomber. It is 69 ft. 3 in. in length and 15 ft. in height. This military monoplane is of special interest because it is neither a high wing nor a low wing machine, the wing being in a mid-way position. This wing is of 84 ft. span and is built of a light alloy that is used also for a portion of the covering, the remainder being fabric. The fuselage also is of metal. The undercarriage is of the divided type and, like the wing flaps, is operated hydraulically; it can be drawn up when the aeroplane is in flight. There are three enclosed gun turrets, one in the nose, one on the underside of the fuselage and just to the rear of the wing, and the third at the extreme stern of the machine. The raised cockpit for the pilot provides a clear view over the front gun turret.



The Armstrong Whitworth "Whitley" Bomber. It is a middle-wing machine, and has three enclosed gun turrets. Photograph by courtesy of Sir W. G. Armstrong Whitworth Aircraft Ltd.

The "Whitley" has two Armstrong Siddeley "Tiger" IX engines, each of which develops 804 h.p. at 7,200 ft. They are mounted in nacelles that project from the leading edge of the wing, one on each side of the fuselage. Controllable-pitch airscrews are fitted. No details of the performance of this machine are available, but it is known to be exceptionally high considering the heavy load-carrying capacity.

### Zeppelin Notes

The disasters to the *"Akron"* and the *"Macon"* turned public opinion in the United States against the use of giant airships, but the success of the *"Hindenburg,"* following upon the long series of regular ocean flights by the *"Graf Zeppelin,"* has revived interest there in the practicability of lighter-than-air aircraft. There is no indication of any similar revival in Great Britain, but Japan is said to be thinking of purchasing two Zeppelins and using them on a proposed five-day airship service between Tokio, Vancouver and San Francisco.

In Germany work on the LZ.130, a sister ship to the *"Hindenburg,"* is being pressed forward. When this latest Zeppelin is put into service the veteran *"Graf Zeppelin"* will be retired from the South Atlantic route, and will be used only as a training ship.

A splendidly-equipped airship port has been built at Frankfurt-on-Main in connection with the German airship service to America. The *"Hindenburg,"* on the completion of her maiden return flight from America, was the first airship to land passengers at the new airport, and the *"Graf Zeppelin,"* on 11th May last, was the first to take passengers on board there.

The Royal Aeronautical Society have awarded the British Gold Medal for Aeronautics to Dr. Hugo Eckener, the famous Zeppelin designer, for his technical accomplishments in lighter-than-air aircraft.

### Imperial Airways' 100 Pilots

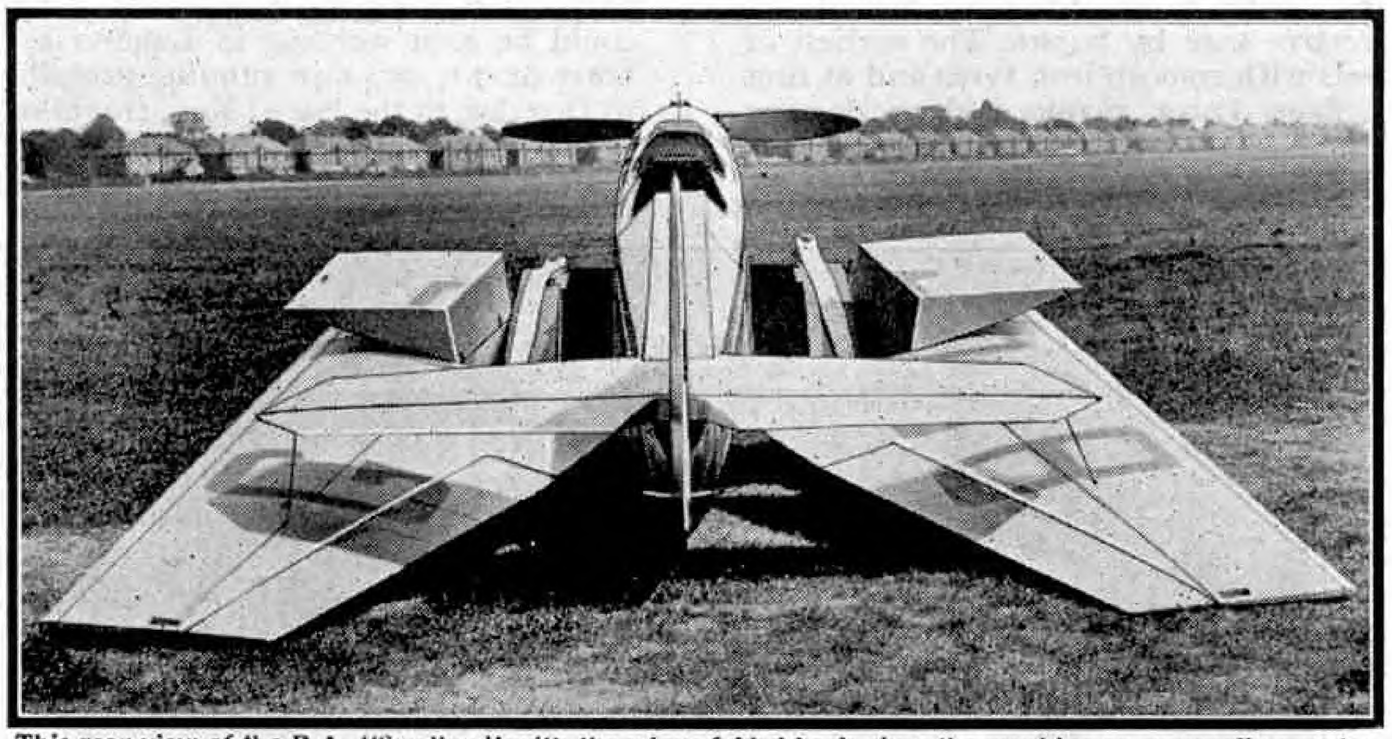
There are now just over 100 pilots engaged in flying the aircraft of Imperial Airways on the company's European and Empire routes. Some of the pilots are Captains and others are First Officers. For organisation purposes the territory covered by those routes is divided into four divisions. No. 1 operating division covers Europe, and on it more than 30 pilots are employed. There are just over 30 pilots on No. 2 operating division, which covers the Mediterranean and extends as far as Karachi on the India route and Kisumu in Africa, and along the West Africa route. On No. 3 operating division, stretching from Karachi to Singapore and including the new air mail link between Penang and Hong Kong, the total number of pilots is about 20; and on No. 4 operating division, which covers the Africa route from Kisumu to Johannesburg, five Captains and five First Officers are now engaged. Several other pilots are on special duties in Africa, Newfoundland and elsewhere.

In addition to the pilots now in regular service, many more are in training at the "finishing school" mentioned in these pages last month. This was established by Imperial Airways to train pilots for new duties under the Empire air route expansion programme that will come into operation next year.

### Dutch and Polish Summer Services

This summer Royal Dutch Airlines (K.L.M.) are operating six services daily between London and the Continent, and some very good timing is being maintained. Prague is reached from London in five hours, Vienna in six hours and Budapest in 7½ hrs. This swift journey is made possible by the service called the Blue Danube Air Express and operated every weekday, in co-operation with C.L.S., the Czecho-slovakian air transport company. Another of the six services is worked in conjunction with the Deutsche Luft Hans and links up London, Amsterdam and Berlin. The K.L.M. service between Amsterdam, Doncaster and Liverpool opens on the 1st of this month.

The summer services worked by L.O.T., the important Polish air transport company, include daily services between Danzig and Cracow, Warsaw and Katowice, and Warsaw and Berlin, and a thrice-weekly service linking up Warsaw and Salonica. New services planned for later in the year will give regular air transport between Warsaw and Moscow by way of Minsk, and between Gdynia, Malmo and Copenhagen. Douglas D.C.2s and Lockheed "Electras" are used.



This rear view of the B.A. "Swallow" with the wings folded back gives the machine an unusually angular appearance. Photograph by courtesy of "The Aeroplane."

### Latest D.H. Aeroplane

The de Havilland company are now at work on their 91st design. This is a four-engined monoplane called the "Albatross," and two machines of this new type are being constructed for the Air Ministry. It is believed that they will be used for experimental flights across the Atlantic Ocean. The engines of the new aeroplanes will be of the D.H. "Gipsy Six" XII type.

The company's 90th design was the "Dragonfly," and an illustrated description of this twin-engined biplane appeared in last month's *"M.M."*

### Avro Aircraft for Abroad

Avro aircraft are much in demand abroad, and several important orders from foreign countries are in hand at the Avro factory. Greece has ordered 30 "Tutors" and nine 626s, both types of equal-span single-bay biplanes designed for training duties. An order has also been received from Austria for three 626 machines. The Avro "Anson," the military version of the 652 twin-engined low wing cabin monoplane, has attracted attention abroad, and 38 machines of this type are to be supplied to Australia.

# The Story of the Tramcar

## From Horse Cars to Electric Traction

FOR many years electric tramways have provided the chief means of transport in our towns and cities, and they also have been extended to connect large centres of population with the surrounding districts. To-day they are being challenged vigorously by motor bus services, which in some towns have replaced them in part or even entirely. Tramway engineers are meeting this challenge by providing comfortable and speedy tramcars of large capacity and attractive appearance, and in view of the struggle now proceeding, it is interesting to trace the development of the rail vehicle that has served our needs so long.

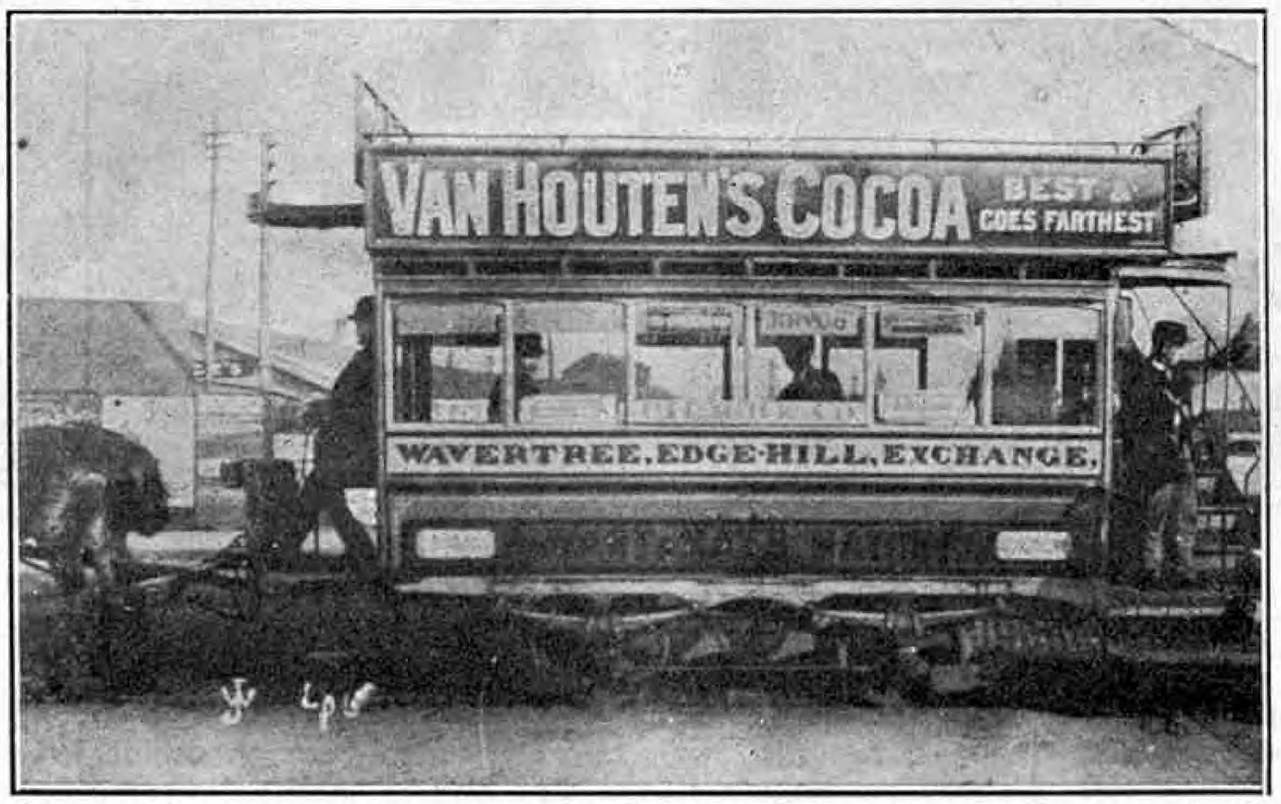
The iron rail may be said to have been developed to meet the requirements of the coal industry in Northern England and the Midlands. During the 18th century speedier means of transporting the coal brought to the pit head became necessary. Carts then were replaced by wagons of larger capacity running on specially constructed roadways along which heavy loads could be drawn with comparative ease by horses. The earliest of these larger wagons had wheels with smooth iron tyres and at first ran on ways made of stone flags. Later, planks laid on sleepers buried in the track were used, and as these soon became worn out thin plates of iron were nailed on them to protect their surfaces. It was then a natural step to make rails or plates entirely of iron.



One of the luxurious single deck tramcars of the Blackpool system. Current is collected by a pantagraph instead of the more usual trolley. Photograph by courtesy of the English Electric Company Ltd.

The plates or rails of most of these early tramways had a vertical flange on the inner side of the track that formed a guide for the wagon wheels. The reverse plan of fitting the wheels with flanges also had been tried, however, and in 1789 William Jessop introduced cast iron edge rails in connection with a railway that he built near Loughborough. This kind of rail is used on our railways to-day.

Tramways or railways in the streets of a town cannot be built in the same manner as the track of an ordinary railway, for rails above the ground would be in the way of wheeled traffic. No attempt therefore appears to have been made to develop them until 1832, when an experimental horse tramway for the convenience of passengers was laid down in New York, but was not a success. In 1852 Loubat, a French engineer, invented a heavy rolled iron rail with a groove in its upper surface in which the flange of a tram wheel could be engaged, and in the same year the scheme for street tramways was revived in New York. Europe's first tramway was not laid until 1860, when George Francis Train, an American engineer, constructed a pioneer track at Birkenhead. Only part of the rail first used could be kept flush with the surface of the road and the raised portion was found to be a great inconvenience to ordinary wheeled traffic. In 1864 it was replaced by a grooved rail. It is interesting to find that the shape of the upper surface of the tramway rail has remained practically the same ever since that time.




A Liverpool horse drawn tramcar of other days. It is strangely in contrast with the modern electric vehicles now used, one of which is shown on the opposite page.

Train's success at Birkenhead encouraged him to build tramways between Marble Arch and Notting Hill Gate, and between Victoria Station and Kennington Gate, in London. In 1868 the Liverpool Tramways Co. Ltd. was incorporated, and other tramways then were built in various parts of the country. The cars were drawn by horses. They were small and slow in comparison with modern tramcars, and it was necessary to hitch on additional horses in order to pull them up steep inclines. For various reasons they survived until a comparatively late period and could be seen working in London as recently as 1912. The only horse-drawn cars now running probably are those in which visitors to Douglas, in the Isle of Man, travel sedately along the Promenade.

The next step in the development of the tramcar was to substitute some form of power unit for the horse. The steam engine was the first to be tried and steam tramcars made their first appearance in Great Britain in 1871 at Leith. They took various forms. One used in the Birmingham and Dudley district had a vertical boiler and engine in the middle, together with a coal bunker and a feed water tank, and the passengers sat in front and behind. Other systems employed separate engines, the lower parts of which were covered almost to the ground by a sheet metal casing, and these drew behind them cars with either one or two decks. The sight of these weird monsters rumbling noisily through our streets and emitting clouds of smoke would astonish us to-day.

Another type of engine tried out in 1876 in the Vale of Clyde was driven by compressed air, and in other places experiments were tried with tramcars driven by gas engines. A more interesting scheme that was employed for many years in Edinburgh made use of a cable in an underground conduit between the rails. The cable was hauled along continuously at a speed of about 8 m.p.h. by means of stationary engines, and the cars were provided with grips that descended through a slot between the rails. The

grips were operated by turning large wheels on the driver's platform, and the cars were stopped when required by releasing the cable and applying the brakes. One of the drawbacks of the system was the lack of speed.

With the coming of the electrical age, it was natural to use the new power for tramways, for it promised to be cleaner and more convenient than steam. What is believed to have been the first experimental electric tramway for passenger use was constructed in Budapest in 1881. It was followed by a pioneer line between Giant's Causeway and Portrush, in Northern Ireland, that was opened in 1883, and this system was the first hydro-electric tramway or railway in the world. Another electric line was opened at Brighton Beach, also in 1883, but the first regular electric tramway system was that of Blackpool, service on which began in 1884.




A modern electric tramcar. This illustration and the lower one on the opposite page are reproduced by courtesy of Mr. W. G. Marks, M.Inst.T., General Manager, Liverpool Corporation Passenger Transport Dept.

Current was supplied to the tramcars of the Giant's Causeway line by means of a third rail carried at the side of the track on posts that raised it 17 in. above the ground. This system of course could not be used for street tramways and three main types of electric system have been tried in adapting electric traction to roads and streets. In one of these the electric cable or rail was laid in an underground conduit between the running rails; in the second surface contacts were provided; and overhead conductors were used in the third, which eventually proved best.

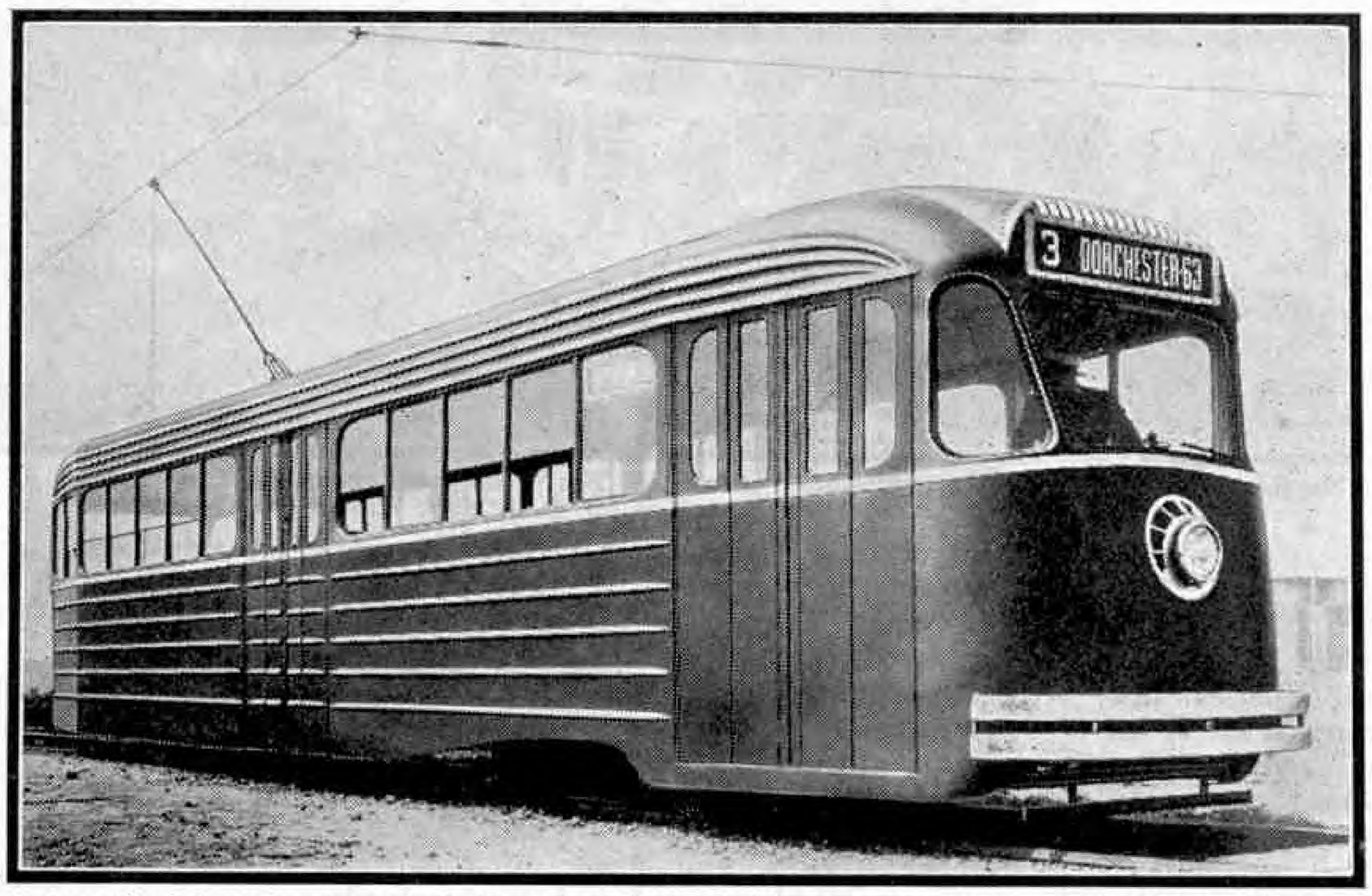
In the conduit system the current was collected by a trolley pole that was pressed down through a slot in the road by means of a spring, and made contact with the underground conductor. The original Blackpool tramway was operated on the conduit system and portions of the old track may still be seen in some of the side streets there. A similar system was formerly used at Bournemouth, where the conduit was under one of the track rails. It was difficult and costly to keep the conduit well drained, and its construction interfered with gas and water mains. The system therefore is now used only in certain parts of large cities where overhead wires are impossible or undesirable, and in this country is employed only in London.

The surface contact system was introduced to avoid the cost and inconvenience of underground conduits. Current was supplied by an underground cable and tapped off from metal studs, 10 to 15 ft. apart, placed along the centre of the track and projecting slightly above the road surface. These studs were "alive" only when a car was passing over them, underground contacts then being made automatically by various means, and current was taken from them by sliding brushes beneath the car. The system was tried in London, Wolverhampton, Lincoln and elsewhere, but proved unreliable.

The first line with overhead wires was opened in 1889 in New York, and in 1892 the earliest to be used in this country was constructed at Roundhay, Leeds. Overhead conductors are now practically universal. The wires are supported by bracket arms projecting from standards, or by cross wires attached to buildings on each side of the road. Current is collected from them by a small grooved wheel at the end of a long trolley arm that is kept in position by means of strong springs, and the electric circuit is completed through the electric motors to the track rails. Current usually is supplied at 500 V. At distances from the generating station the voltage is reduced appreciably by the resistance of the conducting wires, and for this reason a system is divided into sections, each supplied with current at the required voltage through transformer stations fed with current at 5,000 volts.

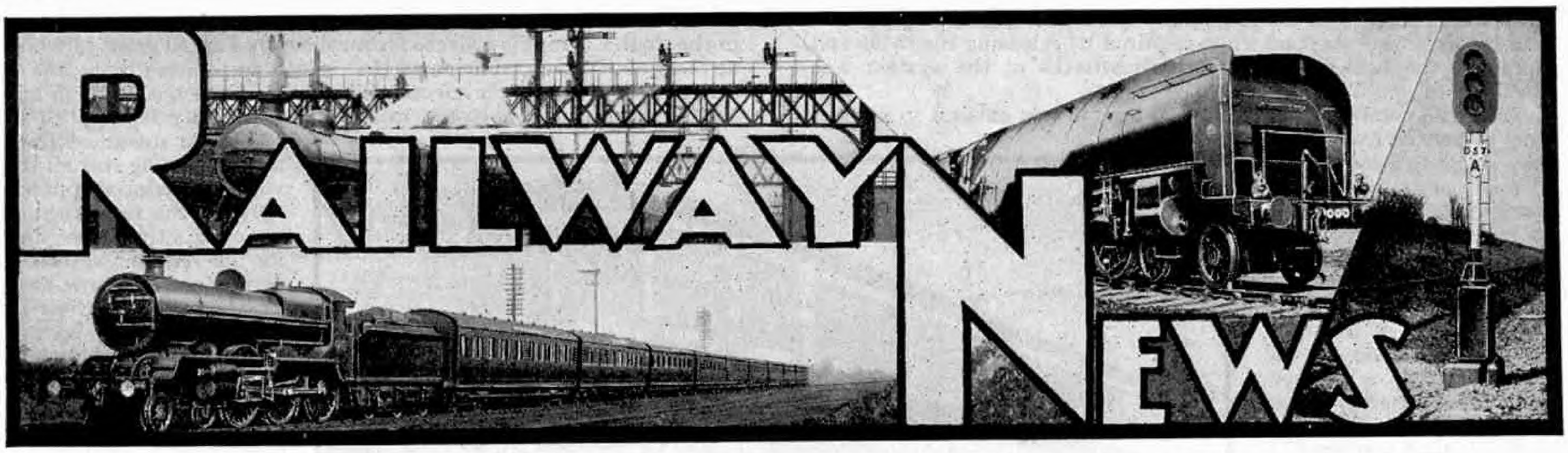
Great improvements have recently been made, both in the track and in the tramcars themselves in order to provide speedy and comfortable transport. The two-wheeled axle is being displaced by the four-wheeled bogie, so that instead of swaying wildly at high speeds the tramcars glide along smoothly with less wear and tear on the track, owing to the better distribution of their weight. Light metals and alloys are used in constructional work, and the introduction of rubber-cushioned seats has added greatly to the attractions of a tramcar journey.

Excellent examples of what has been done in this direction are the latest types of tramcar introduced in Liverpool, one of which is illustrated on this page. The luxurious cars designed by Mr. W. Luff, Transport Manager to the Blackpool Corporation, and supplied by the English Electric Co. Ltd. for service in Blackpool also are of outstanding interest. One of these is seen in the upper illustration on the opposite page. It is a closed single decker, but has sliding sections in its roof that can be opened when required and locked in any desired position. Passengers can be quickly taken up through the wide central doors. Inside they find a well ventilated atmosphere at all times, and electric heaters controlled by the driver provide a comfortable warmth in cold weather. Wide windows give an excellent outlook in all directions. On a straight track the new cars attain a speed of 31 m.p.h.




A streamlined American tramcar that travels at 50 m.p.h. Photograph by courtesy of the General Electric Company of New York.

The call for speed on tramcar routes is not so great in this country as in some parts of the United States, where traffic congestion is being overcome by the use of streamlined speedy cars of almost revolutionary appearance. A type of car supplied with electrical equipment by the General Electric Co., of New York, and introduced for use in Brooklyn is illustrated on this page. This car is capable of travelling at 50 m.p.h. and starting from rest it can reach a speed of 17 m.p.h. in 5 sec. and attains 25 m.p.h. in 11 sec. High speeds can be employed safely, for three types of brakes are installed, working on the motors, the wheels and the track respectively, and when travelling at 32 m.p.h. the car can be stopped in less than 100 ft. Each car is equipped with four 55 h.p. motors and has accommodation for 60 passengers on its single deck. Its interior is well ventilated, and during the winter electrical resistance heaters are used for providing a comfortable temperature.




### *"King Edward VIII"*

With the consent of His Majesty The King one of the well-known G.W.R. locomotives of the "King" class, No. 6029, has been named *"King Edward VIII."* This engine was the last of the class to be built and was originally named *"King Stephen."* It is attached to Old Oak Common (London) Locomotive sheds and takes its turn on the principal expresses worked by engines from that depot, including the *"Cornish Riviera Limited"* and *"The Bristolian."*

Among the named engines condemned in recent months were No. 3263, *"St. Michael,"* and No. 3288, *"Mendip,"* both of the 4–4–0 "Duke" class, and No. 3327, *"Marco Polo,"* and No. 3412, *"John G. Griffiths,"* of the "Bulldog" class. No. 3422 of the latter class also has been condemned. This engine was formerly named *"Aberystwyth,"* but lost its name as the result of the decision some years ago to remove "place names" from G.W.R. locomotives.

With the designing this year of a new class of 4–6–0 mixed traffic locomotives, several of the "43XX" series of 2–6–0 "Moguls" have been withdrawn. The first locomotives of this useful class were built at Swindon in 1911.

### Locomotive News from Ireland

G.N.R. (I) 4–4–0 locomotive No. 172 of the familiar "Carrantuohill" series has been equipped for oil burning. This is an interesting development in view of the fact that coal for Irish locomotives has to be imported. The first experiments are being made with ordinary heavy oil fuel, but it is stated that there is a possibility of the use of the by-products of the oil refineries in the Irish Free State.

All the 2–6–0 locomotives on the N.C.C. section of the L.M.S.R., the work of which was referred to in the *"M.M."* last January, have now received names. These are as follows: No. 90, *"Duke of Abercorn"*; No. 91, *"The Bush"*; No. 92, *"The Bann"*; No. 93, *"The Foyle"*; No. 94, *"The Maine"*; No. 95, *"The Braid"*; No. 96, *"Silver Jubilee"*; No. 97, *"Earl of Ulster."*

### New L.N.E.R. Rolling Stock

Since the beginning of the spring services new rolling stock has been in use on the L.N.E.R. *"Hook and Antwerp Continental"* service from Liverpool Street. This has been provided with the object of making the nightly Continental service of a high standard throughout for all passengers, and in order to combine in a single boat train accommodation ranging from the ordinary third-class to first-class Pullman. All compartments on the train provide seating for three passengers on each side, and arm rests are fitted throughout. The heating, ventilation and other arrangements for the comfort of passengers have been given special attention. Ample luggage accommodation is provided and the formation includes an all-electric kitchen car. The external design and finish of the train conform with the usual L.N.E.R. standards.

The latest type of corridor vehicles, as used on the principal main line services, are now employed on the trains between Leeds and Scarborough and between Newcastle and Carlisle. As in the boat train vehicles already mentioned, three-a-side seating is standard. Between Newcastle and Carlisle seven trains each way daily now have buffet cars attached; 4–4–0 "Hunt" class locomotives are largely used on this line.



"The Royal Scot" express on the southern ascent to Shap. The locomotive is one of the four-cylinder 4–6–2s No. 6204, "Princess Louise." Photograph by Mr. J. G. Muir, West Kirby, Cheshire.

### L.M.S.R. Locomotive News

After several alternate weeks of duty on the Liverpool and Anglo-Scottish services respectively from Euston, the L.M.S.R. "Turbomotive" No. 6202 recently carried out a series of trials with the dynamometer car on the chief Anglo-Scottish trains. It was handled throughout by Crewe enginemen.

The later engines of the "Jubilee" class, Nos. 5665–5742, differ from the earlier ones in having boilers with the regulator valve situated in the dome, not in the smoke-box. The top-feed fittings are not now applied at the sides of the dome cover as previously, but are housed in a separate "hump" in front of the dome, as in the case of No. 6170, *"British Legion,"* which was illustrated on page 23 of the January *"M.M."* Unlike this engine, the latest "Jubilees" have the feed pipes concealed beneath the outer covering of the boiler barrel. Future engines of the 4–6–0 and 2–8–0 classes will incorporate this arrangement.

All new L.M.S.R. locomotives are to have a new style of numbering and lettering. The engine numbers, classification numbers on cab-sides, the Company's initials and the numbers on the smoke-box front will be executed in plain block style instead of in Roman characters. The letters and numbers will be in gilt, with black shading for red-painted passenger engines, and red shading for black-painted passenger engines. On the black freight engines the characters will be of plain block type in gilt, without any shading.

### Extensive L.N.E.R. Orders

Large contracts have been placed by the L.N.E.R. for the supply of steel rails, including 750 tons of conductor rails. In addition two locomotive coaling plants are to be supplied; one, mechanically-operated, for Carlisle, and the other, electrically-operated, for Grantham. The locomotive depot at Ardsley, near Leeds, is to be provided with hot water boiler washing apparatus recently ordered. Outside builders are to supply 100 bogie bolster wagons.

### Names for New L.N.E.R. Locomotives

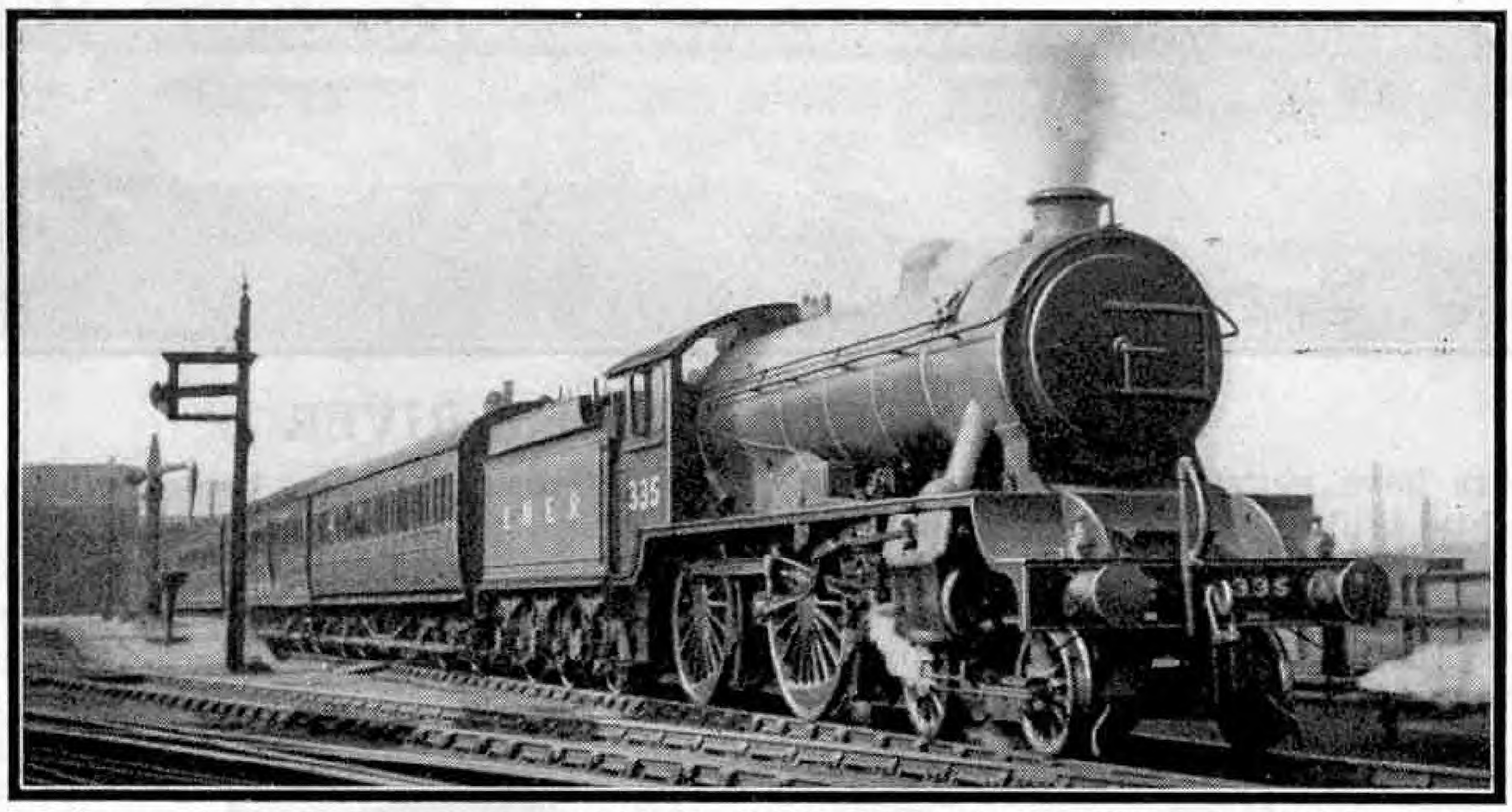
Further "Football Club" names have been selected for the L.N.E.R. locomotives of the "Sandringham" class now in course of construction at the works of Robert Stephenson and Co. Ltd., Darlington. These are: *"Manchester City," "Everton," "Liverpool," "Leicester City," "Nottingham Forest," "Bradford," "Bradford City," "Barnsley," "Manchester United," "Tottenham Hotspur,"* and *"West Ham United."*

At the time of writing four further 2–8–2 "Mikado" locomotives of the "Cock O' The North" class are approaching completion at Doncaster, and it is stated that they are to be named *"Lord President," "Mons Meg," "Thane of Fife,"* and *"Wolf of Badenoch"* respectively. Progress also has been made with the new 2–6–2 "Prairie" design of tender locomotive that was foreshadowed in the April 1935 *"M.M."* Possibly some of each class will be in service by the time these lines appear in print.

An interesting transformation has been effected in the rebuilding of "Atlantic" locomotive No. 2212 of the former North Eastern class "Z." It has new cylinders, Lentz poppet valves and other modifications that render the engine similar to No. 732 of the same class, the conversion of which was referred to in the April 1934 *"M.M."* Formerly No. 2212 was an exceptional member of the "Z" class in having cylinders arranged on "uniflow" principles whereby the steam was exhausted from the cylinders by means of central ports, the end ports being used for admission only. Another North Eastern engine, No. 825 of the 4–6–0 mixed traffic type, also was fitted with "uniflow" cylinders, but has since been converted to the normal arrangement.

### L.N.E.R. Main Line Electrification

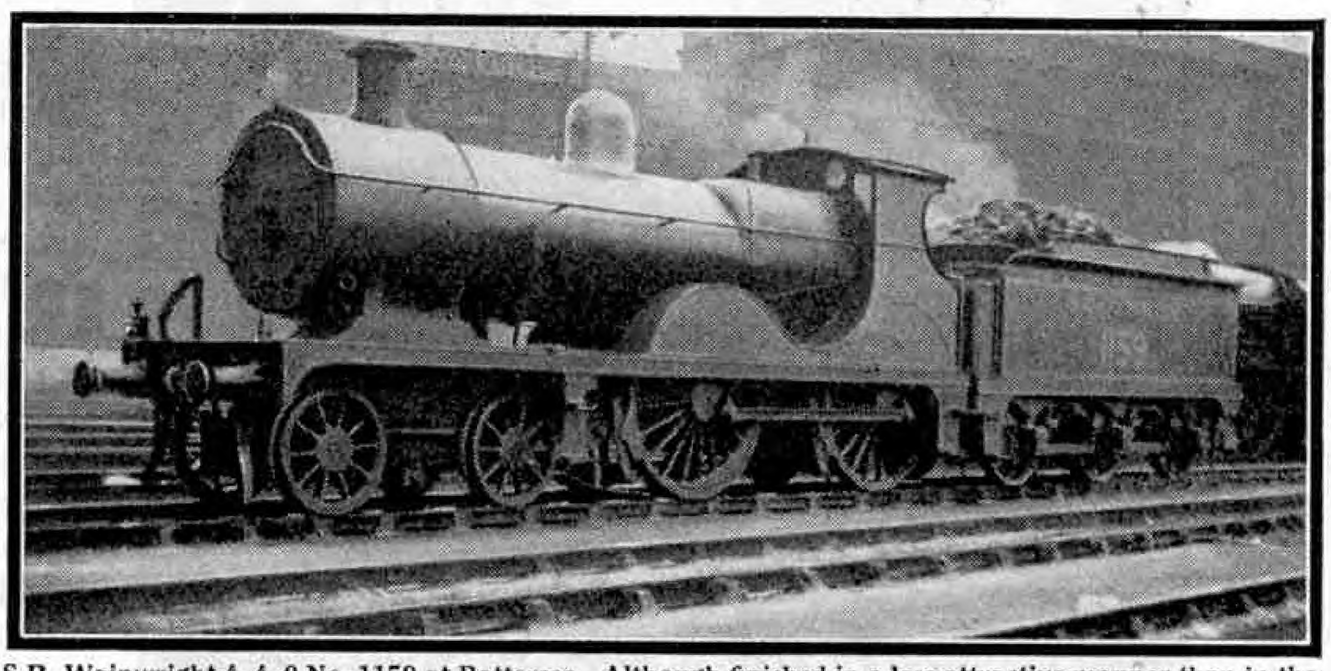
The L.N.E.R. Government-assisted scheme provides for the first time in this country for the electrification of a section of main line for both passenger and freight working Between Sheffield and Manchester the line passes through the Pennines and is suitable for electric working because it carries a dense traffic on heavy gradients. The 1,500-volt direct current system with overhead equipment will be installed, and all the haulage will be performed by electric locomotives. Trains of every class will move faster as a result. It is stated that half an hour will be saved on the running time of a braked goods train from Sheffield to Ardwick (Manchester). The average speed of a heavy mineral train will be 27 m.p.h., or double its rate of movement to-day. The headway between trains passing through Woodhead tunnel will be 5 to 7½ min., instead of the present interval of quarter of an hour. The abolition of smoke in the tunnel will be a great advantage to travellers, and the life of the rails through it will be lengthened as the result of the improvement in the atmosphere. The route is ideal for electrification and plenty of power is available throughout.



A Hull express leaving Sheffield (Victoria) hauled by No. 335 "Bedfordshire" of the "Shire" class. This is one of the engines with Lentz Oscillating-Camshaft poppet valves operated by Walschaerts valve gear. (H.R.C. prize-winning photo.)

### L.M.S.R. Tender Allocations

Since the announcement that locomotives of the "Royal Scot" class are to be provided with 4,000-gallon tenders taken from engines of the "Silver Jubilee" series, readers have noted some tender allocations that appeared to contradict the first statement. When the present tender exchanges and building programmes are completed, "Silver Jubilee" class engines Nos. 5552, 5617-41, and 5643-66 will have tenders of 3,500-gallons capacity with curved top edges to the sides. Nos. 5553–74, 5585–5606, No. 5642 and Nos. 5695–5725 will have 3,500-gallon tenders of the former standard type with straight sides and with coal rails, similar to those running with the "Baby Scots" and formerly in use with the "Royal Scots." Nos. 5607–16 will have the 3,500-gallon tenders, with high straight sides and no coal rails, that were originally running with the first engines of the class. Nos. 5575–84, 5667–94 and 5726–42 will retain the large 4,000-gallon tenders with high sides having curved top edges.



S.R. Wainwright 4–4–0 No. 1159 at Battersea. Although finished in a less attractive manner than in the days of the S.E.C.R. the engine displays the graceful lines that have always distinguished the class. (H.R.C. prize-winning photograph.)

### Fine Running on the L.M.S.R. (Midland Division)

On a recent run with the down *"Thames-Forth Express,"* one of the "Silver Jubilee" class 4–6–0s, No. 5611, gained no less than 19 minutes net between St. Pancras and Leeds. With a load of 235 tons the 123½ miles to Nottingham were run in 128 minutes, including three slacks, or 121 minutes net; three times the speed rose to over 80 m.p.h., the highest rate being 85½ on the final descent into Nottingham. With three permanent way checks 2 minutes were lost on to Chesterfield, but by a fine climb to Dronfield tunnel three minutes were regained on the short run of 12¼ miles on to Sheffield, the minimum on the 1 in 100 ascent being 38 m.p.h. Sheffield was left a minute late, but with a reduced load of 205 tons the remaining 39½ miles to Leeds took only 45¾ minutes, in spite of one dead stand for signals and a further p.w. check; the net time was 41½ minutes, an unusual time for this stretch. The highest speed was 71 m.p.h. at Wath-on-Dearne. Leeds was reached two minutes early.

With a heavy load of 355 tons, No. 5662 *"Kempenfelt"* ran from Leicester to St. Pancras, 99 miles, in 105 minutes. The road is hilly but the uphill work was very good; up the three miles at 1 in 120 south of Irchester speed did not fall below 44½ m.p.h., and the 19.6 miles from Bedford up to Luton were run at an average speed of 55 m.p.h. Speeds were 76 before Market Harborough, 78 at Kettering and 77½ at Radlett, and over the 72 miles from Glendon to Finchley Road an average speed of 64 m.p.h. was maintained.

We are indebted to Mr. O. S. Nock for these timings.

### Systematic Times on the French State Railways

The arrangement of train services on a systematic basis, whereby departures are made at regular intervals, has now been adopted by the French State Railways. Between Paris and Havre the advantages of this form of operation are combined also with high speed. Ten trains in each direction daily cover the 141 miles between the two cities at an average altogether of 60.8 m.p.h. High-speed rail cars are responsible for three of these services each way and these make an average speed of 72 m.p.h. Altogether the effect of the changes is to provide one of the fastest inter-city services in the world.

Systematic timings are also in force on the route to Cherbourg, but the speeds there are lower. Good use is made of rail cars for intermediate and connecting services and further developments are likely.



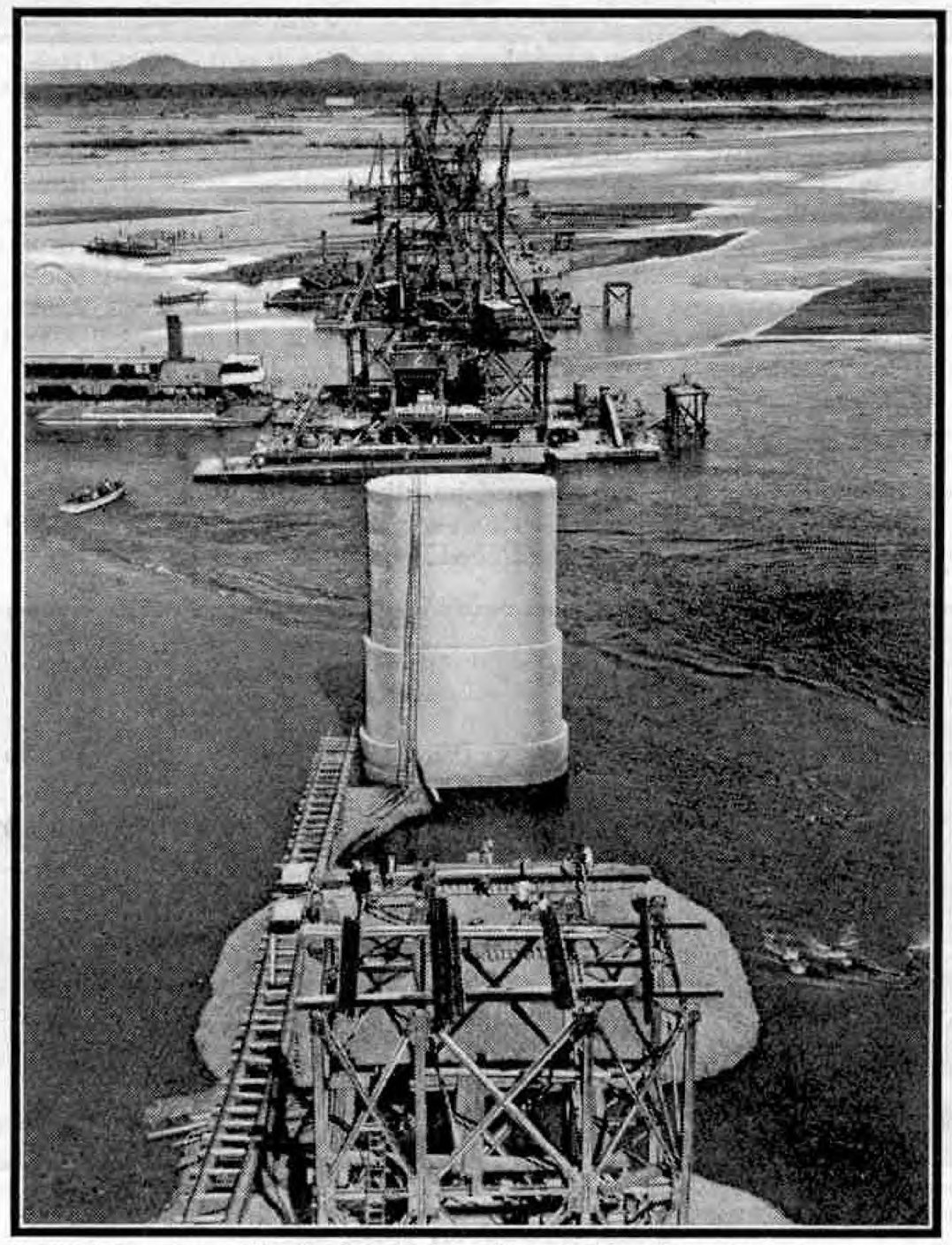

## SPANNING THE ZAMBESI RIVER

BRITISH engineers have gained a great reputation by building mighty bridges and constructing great canals and dams in remote parts of the world. One of the greatest of their triumphs was the construction of a railway bridge across the lower reaches of the Zambesi River. This structure was completed early last year, and is the longest railway bridge in the world that is continually over water. It has an overall length of 12,064 ft. 4 in., or about $2\frac{1}{4}$ miles.

The completion of the bridge marks a new era in the development of British Nyasaland, on the north side of the Zambesi River, for now there is direct communication between that country and the port of Beira in Portuguese East Africa. The simplification of transport that this has brought about is of great importance, for British Nyasaland is an agricultural country of great possibilities and Beira is the most convenient outlet for its products. The country also possesses valuable mineral resources, and these can be developed with advantage now that adequate connection with the coast has been provided.

Before the bridge was built a ferry service between Chindio, on the north bank, and Murraca, on the south bank, was the only means of crossing the Zambesi River. These villages are about 90 miles from the mouth of the river, and the ferry between them connected the Shire Highlands Railway in British Nyasaland with the railways of Portuguese East Africa. It was a very unsatisfactory link between the two countries, for it could only be operated during four months of the year, for the river is in flood from December to March, and then spreads over the country for miles around; and from August to November it is so shallow that it can be crossed only in flat-bottomed barges pulled by teams of native boys wading through the water.

When the ferry was in full operation it was maintained by stern-wheel steamers of shallow draught and barges. Apart from the inconvenience of the change from rail to water carriage and back again, time and labour were wasted in the trans-shipment of merchandise, for the sudden changes in level to which the river is liable made it impossible to construct regular landing bases equipped with cranes and conveyors. A further serious difficulty was that the seasonal floods not only disrupted the ferry service, but frequently washed out stretches 20 miles in length of the railway line itself.



Building the piers of the world's longest railway bridge. Those shown in course of construction are in the main channel of the Zambesi River. The illustrations to this article are reproduced by courtesy of "Modern Transport."

The only way to overcome these difficulties was to build a bridge across the river, and this task was undertaken by the Cleveland Bridge and Engineering Co. Ltd., Darlington. The work involved far more than the erection of the bridge itself, for it was necessary to build new lines to the site chosen for the bridge at Sena, a village about 25 miles upstream from the ferry and at a point where the river flows between well defined banks and has a permanent channel.

The railway on the north was extended to the position of the bridge by a line about $3\frac{1}{4}$ miles in length. This change necessitated the abandonment of 24 miles of track, but this was no great loss, for the section cut out was the one chiefly affected by floods.

On the south side of the river a new line 25 miles in length was constructed from Murraca to Sena to extend the railway on the south of the river to the position of the bridge. This section runs through country that is liable to flooding, and was therefore built on an embankment that is 11 ft. to 20 ft. above ground level and is of special cross-section to give it strength to resist floods.

The river turns in a southward direction at Sena and

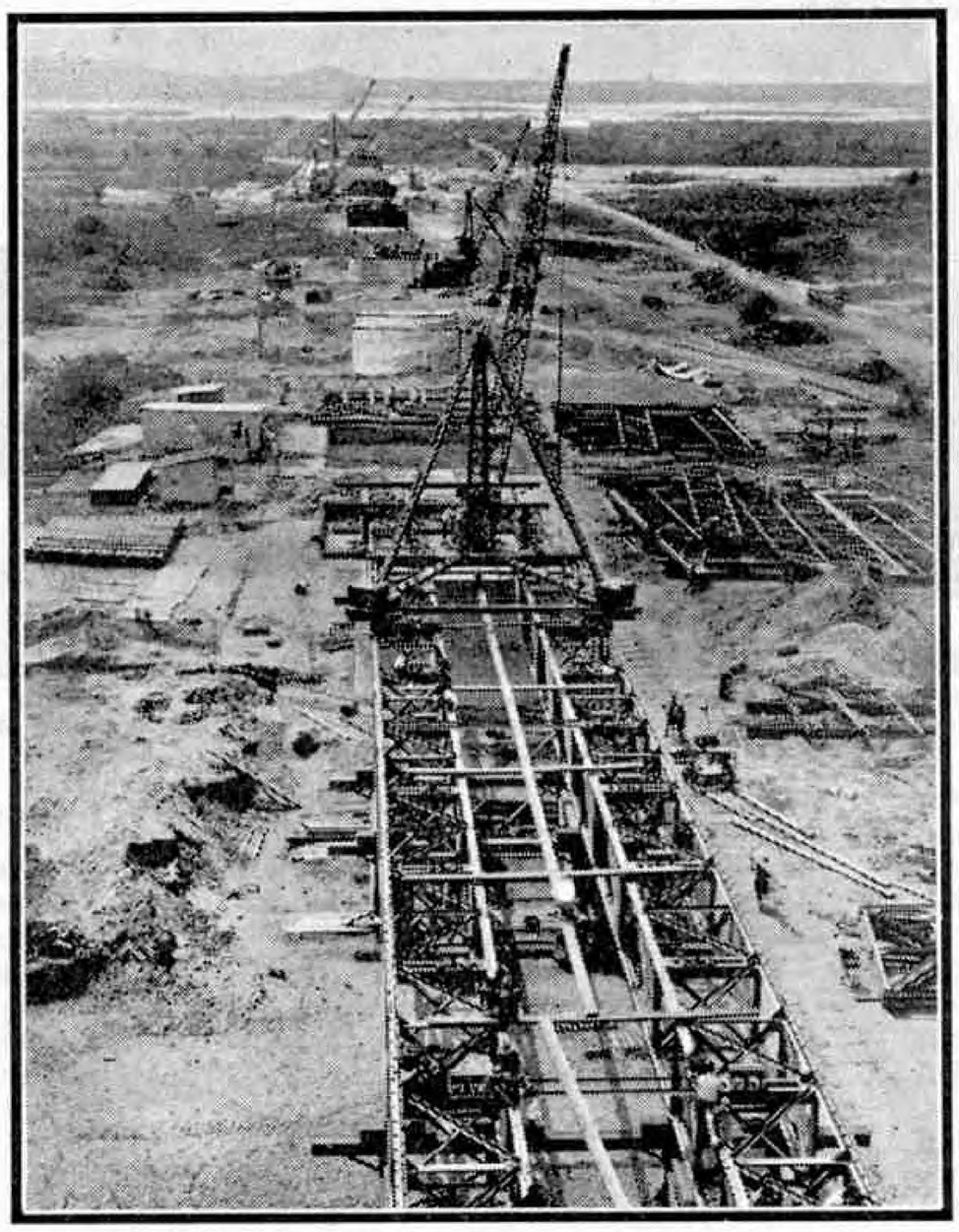
the line of the bridge is almost due east and west. The most difficult part of the work of course was the construction of the bridge itself. This has 33 main steelwork spans, and these are flanked on the west side by seven intermediate spans, each of which has a length of 165 ft. Each of the main spans is 262 ft. 6 in. in length, giving this section of the bridge alone a length of more than 1½ miles, and the highest of them stands 27 ft. above high water level. The permanent way on the east bank of the river is higher than that on the west, and 19 of the main spans therefore were constructed with a slight incline, mainly of one in 216.




A panorama of the lower Zambesi River, showing the site of the bridge. There the river normally is about 5,000 ft. wide, but at high flood the total width is about 2½ miles.

The main spans are carried by 34 piers, two of which were founded directly on the rock of the left bank on the north side of the river. The remaining 32 were built in the bed of the river itself. No water flows on a large part of the southern side of this during the dry season, and there it was possible to work directly, material being brought to the positions of the piers by means of a constructional railway of 2 ft. gauge. The foundations of some of the other piers were built with the aid of cofferdams, which shut off the river from their sites and enabled these to be laid bare by pumping, but in some cases dredging was sufficient and it was unnecessary to remove the water. Pontoons and barges were moored alongside the pier sites and on these were placed concrete mixers and other necessary equipment.

The work of constructing each pier was begun by sinking an oval steel structure, shaped like the funnel of a steamship, into the bed of the river. This structure was 36 ft. in length and 20 ft. in width and formed a shield within which a strong steel-sided well was sunk. Mechanical grabs were then lowered down shafts to remove the material inside the well, which was built in sections and carried deeper as the excavation continued. The depths to which the wells were taken varied from 80 ft. to 110 ft. below water level and each was filled with concrete reinforced with steel rods as it was sunk, leaving only the shafts used for excavation purposes. Finally these were filled in, giving a solid foundation on which a reinforced concrete pier was built up to take its share in supporting the steelwork of the main spans of the bridge. This process was carried out for each of the piers and the steelwork of the spans was then erected by means of cranes.



Piers on the right bank of the river in course of construction. The bridge has 33 main spans of 262 ft. 6 in. each.

In order to give access to the bridge from the west bank of the river a steel trestle viaduct was built. This is founded on ferro-concrete piles. It is level throughout and has a total length of 1,805 ft. 8 in. The seven intermediate spans already referred to connect it to the western end of the main spans. The approach to the bridge on the east bank consists of six plate girder spans carried on piers about 66 ft. apart, and having a total length of 399 ft.

Work on the bridge began in 1931, and the last span was erected on 12th October, 1934. Its total cost was more than £1,400,000. It is crossed by a single line of 3 ft. 6 in. gauge. The rails are set on sleepers made of native hardwood that are spaced not more than 2 ft. apart and are attached to the steelwork on the bridge by hook bolts.

Preparing for the building of a great bridge in a district remote from the great centres of industry is almost as formidable an undertaking as its actual construction, and the Lower Zambesi Bridge was no exception to this rule. Steel cranes, excavators, concrete mixers, forges and other equipment had to be transported to the site from Great Britain, in addition to the steelwork used in the erection of the spans of the bridge and the approach viaduct, and immense quantities of stores, including millions of nuts and bolts and office furniture specially treated to make it suitable for the hot moist climate. Two light draught stern wheel steamers, 20 barges and eight pontoons also were required, and most of these were shipped in parts and assembled at the site. Constructional railways also were laid down. These were of 2 ft. gauge and all the material necessary for them had to be sent out from Great Britain. One service on which this narrow gauge line was engaged was that of transporting the stone required for concrete making from quarries that were opened on each side of the river.

Native labour was employed in building the bridge, and the men were housed in special camps on the two sides of the river that in themselves formed small towns, for the number of men engaged usually was 4,000 and at times rose to 6,000. Feeding this army of men and keeping them in good health was a heavy undertaking.




### A Well-Equipped Fire Engine

The illustration on this page shows an interesting and well-equipped Dennis fire engine, commissioned recently by the Eastbourne Fire Brigade. The body is of the totally enclosed type now favoured by many brigades and affords complete protection for the firemen. It has seating accommodation for 10 men, and is provided with a remarkable variety of equipment, including a canteen cabinet with cups, kettles, Primus stove, etc., oxy-acetylene cutting plant, heavy-capacity sheer-legs with chain-lifting tackle, two search-lights and four cable reels with 700 ft. of cable. There are also two folding stretchers and provision for carrying four sets of breathing apparatus, while on the roof are three special ladders.

The chassis is equipped with a six-cylindered engine that develops 110 b.h.p., and the pump is a multi-stage high-pressure turbine, which is mounted in the forward position, near the driver, and has an output of 650-800 galls. per min. Inlet and two delivery valves are arranged at each side so that the machine can be readily brought into use, irrespective of the position of the water supply or the scene of the fire. A first aid hose is also part of the equipment, and this is fed by the main pump from a 40-gallon tank.

In addition a central gangway in the body carries rails on which runs a Dennis self-contained portable pump, which consists of a single-cylindered water-cooled engine mounted on a tubular frame, together with a turbine pump having an output of 100 galls. per min. This handy unit is very compact, and can be lifted out of the machine by three men.




A fire-engine of interesting design in service with the Eastbourne Fire Brigade. The body provides accommodation for 10 men and at the front is a high-pressure turbine pump that has an output of 650-800 gallons per minute. Photograph by courtesy of Dennis Brothers Ltd., Guildford.

### Roofing the River Mersey

In order to solve the traffic problem presented by the narrowness of certain existing streets in Stockport, Cheshire, and the impossibility of widening them except at a prohibitive cost, a portion of the River Mersey is being roofed over to carry a road 75 ft. wide. The portion of the river to be covered in this manner extends for a distance of a quarter of a mile. The new highway, which is to be known as River Mersey Road, will provide a new east to west route through Stockport that by-passes narrow streets that now have to be negotiated by traffic.

The new road will be a continuous bridge structure with a reinforced concrete deck carried on reinforced concrete portal frames. The carriageway will be 45 ft. in width, and will be divided down the centre by island refuges 5 ft. wide, and will be flanked by footpaths each 15 ft. wide. Work has been in progress for some time on the first portion of the scheme, which consists of the covering of the river in Mersey Square and the reconstruction of Mersey Bridge, and these works have now been completed.

The entire scheme will cost about £128,400 and will require three years to carry out. When completed the new road will be placed in Class 1 category.

### Rocket Assists Engineers

Rocket apparatus of the kind used in carrying a lifeline to a ship in trouble in rough seas has been used recently by engineers in South Africa for the purpose of carrying electric cables across 1,500 ft. of almost impassable mountain country. A thin line was attached to the rocket, which landed within 60 ft. of its objective, and the line was then used to draw a cable across the intervening space. The rocket was designed to give two propelling explosions, the first as it started its flight and the second when it was in mid-air.

### Drilling for Oil in Britain

Great interest centres in the large scale experimental borings now being made in various parts of this country in an endeavour to find oil. Recently the D'Arcy Exploration Company, which is connected with the Anglo-Iranian Oil Company, began to sink a test drilling at Paulsgrove on Portsdown Hill, near Portsmouth, as several outcrops of rock formations to the east and west of this site gave evidence of petroleum impregnation.

The drilling plant installed at Paulsgrove includes a derrick 136 ft. high with a loading capacity of 400 tons, and designed to drill to a depth of over 12,000 ft. The depth to which the drilling is to be carried is one mile, but if oil is not reached the bore will be carried down to two miles later. The cost of drilling is estimated at between £5 and £8 per yard, and it is anticipated by the experts that drilling may continue without success for as long as two years! Other plants are in course of erection near Steyning in Sussex, and on sites in Derbyshire, Lincolnshire and Nottinghamshire.

### Giant Suspension Bridge for Vancouver

This summer Vancouver, Canada's Pacific port, is celebrating its jubilee, and the occasion will be marked by the inauguration of one of the greatest engineering undertakings of recent years. A great suspension bridge is to be built across what are known as the First Narrows at the entrance to Vancouver Harbour. The bridge will be known as the Lion's Gate Bridge. It is claimed that it will be the largest structure of its kind in the British Empire, for it will have a central span 1,500 ft. long and 209 ft. high at the centre. The total length across the First Narrows will be just under a mile.

The bridge will carry a roadway wide enough for four lanes of traffic and two footpaths, and will cost approximately £1,250,000. When completed it will form a link in a highway system that is of great industrial importance in the Canadian Pacific trade, and which runs through some of the finest scenic country in the world.

### Completion of World's Highest Dams

The great Boulder Dam across the Colorado River in the United States of America, the largest constructional work ever undertaken, and the highest dam in the world, is now officially completed. The building of the Dam occupied just 11 days less than five years and cost £11,000,000, and over 5,965,972 cu. yds. of earth and rock were excavated during the construction. The reservoir that is gradually forming behind the Dam has been named Lake Mead and already is more than 80 miles long. It will eventually reach 115 miles up the Colorado River, and will be 40 miles in width with an area of 229 sq. miles.

This huge lake will contain 30,500,000 acre-feet of water and will be the largest man made body of water in the world. In addition to driving huge turbo-generators for the supply of electricity, the water penned up by the Dam will be released as required into specially built canals, to provide an adequate all-the-year-round supply of irrigation water to the surrounding country.

Closely following the completion of Boulder Dam comes the news of that of the second highest dam in the world, the Sautet Dam at the headwaters on the Rhone River in the French Alps. This structure is a thin wall of concrete 414 ft. high, and is built across the narrow canyon of the Drac River. It is second to Boulder Dam in height and its successful completion reflects great credit on French engineering skill, for it is built upon treacherous limestone. In order to prevent water leaking through the rock and around the dam, hundreds of holes were drilled into the foundations near the structure, and 3,000 tons of cement were pumped into them under a pressure of 5,000 lb. per sq. in.

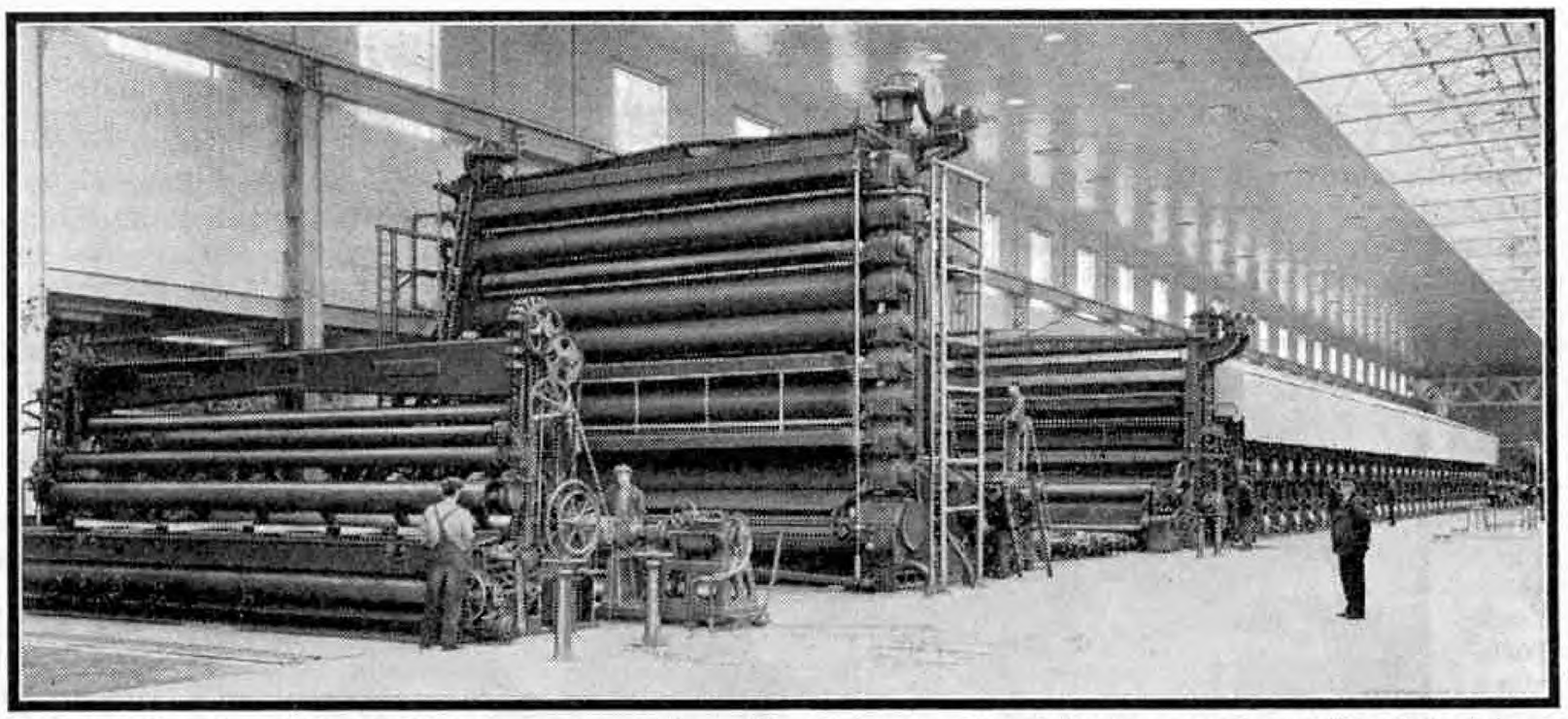
The power plant, consisting of six 13,000 horse-power generating units, is wedged into the bottom of the narrow canyon, and the space available is so narrow that the machines are remote controlled by cables.

### The Carryall Scraper at Work

Le Tourneau Carryall Scrapers as described on page 351 of last month's "*M.M.*," are being used in building the world's greatest earth-filled dam at Fort Peck, in the United States. This machine is hauled by a Diesel-engined tractor, and not by one using petrol, as we inadvertently stated last month.

### World's Largest Paper-Making Machine

In the "*Engineering News*" pages of the May 1936 "*M.M.*," we referred briefly to a great new electric paper-making machine that is installed at the Kemsley Paper Mills of Edward Lloyd Ltd., Sittingbourne, Kent.



An impressive view of the world's largest paper-making mill, which is installed at the Kemsley Paper Mills, Sittingbourne. Photograph by courtesy of Edward Lloyd Ltd., Sittingbourne.

This wonderful machine is the largest of its kind in the world and forms the centre of interest in a big extension scheme that has recently been carried out at these mills. It can produce 320 in. news-print paper at a rate of 1,400 ft. per minute, or about 1,200 tons per week. The machine is nearly 500 ft. in length and weighs 2,000 tons, and is driven entirely by electricity. Some idea of its huge size may be obtained from the fact that when the machine was started up an initial charge of 4,000 gallons of oil was put into the lubricating system. This giant is housed in a specially designed building 550 ft. in length and 175 ft. in width.

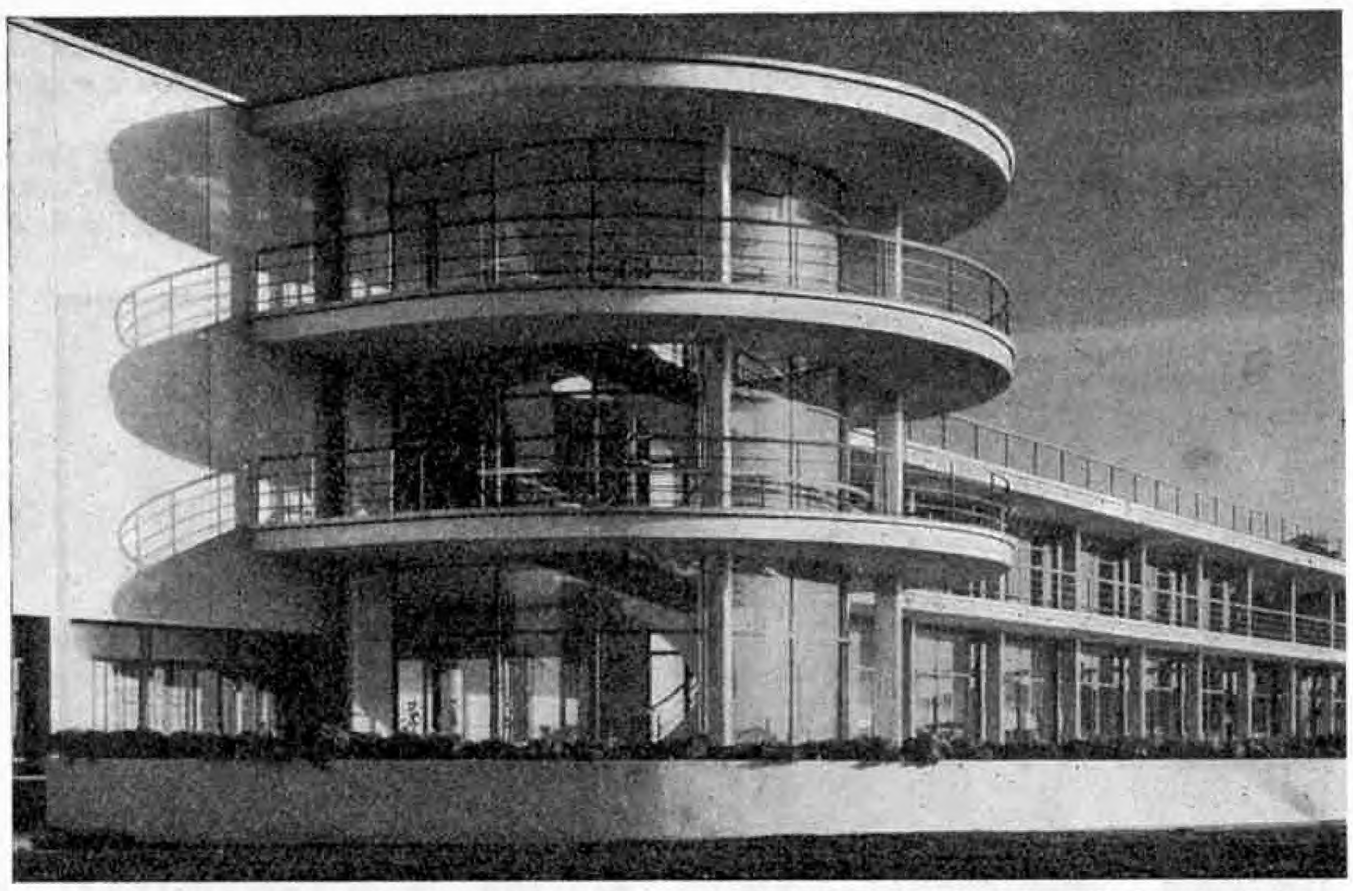
The electrical power plant installed at these Mills is one of the largest industrial installations in the world, and has an annual output sufficient to meet the needs of a large city. The boiler plant includes four high-pressure boilers each capable of turning 45 tons of water per hour into steam.

### New Exhibition Buildings at Earls Court

When the new Earls Court Exhibition Buildings in London are completed this year, it will be one of the largest permanent exhibitions and sports centres in the world dependent for all its lighting, power and heating requirements upon electricity. The area of the site is approximately 20 acres and the main building will cover over six acres, and the electrical energy will be supplied from the Grid through a new generating station now under construction at Fulham. Approximately five million units a year of electricity will be consumed in lighting and power, and the consumption of electricity for heating will amount to between eight million and eleven million units, thus making the total requirements of the new Earls Court almost equal to the needs of a town of 30,000 inhabitants.

### Pavilion with Welded Steel Frame

During the last two years great advances have been made in the application of welding to structural steelwork, and many important steel-framed buildings have been erected in which welding has replaced riveted construction. One of the most notable and recently completed buildings of this kind is the handsome De La Warr Entertainment Pavilion at Bexhill, Sussex, which is shown in the lower illustration on this page. This fine entertainment hall is the first building of this nature in Great Britain to have a welded steel frame, and it includes a large auditorium 116 ft. long, 74 ft. wide and 30 ft. high, a conference hall, lounge, reading room and restaurant. The illustration shows a beautiful cantilevered balcony that forms an imposing part of the building.



This handsome concrete building is the De La Warr Entertainment Hall at Bexhill, Sussex. It has a structural steel framework that was erected entirely by welding. Photograph by courtesy of Murex Welding Processes Ltd., London.

### Large Petrol Tank Floated to New Site

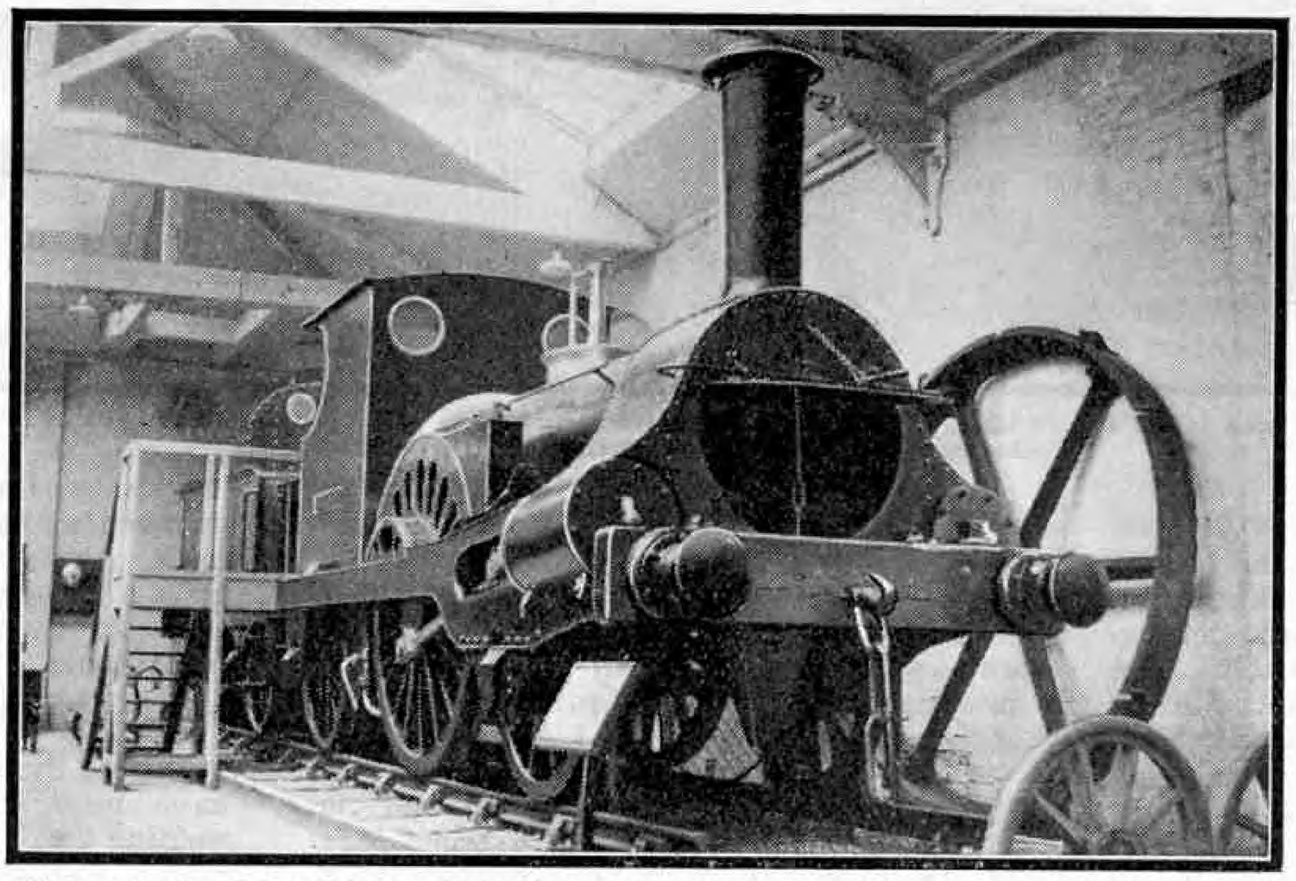
A large petrol storage tank 40 ft. in diameter and 35 ft. high was recently hauled to a new site 150 ft. away, the foundations of which were 9 in. higher. The moving was done by floating the tank on an artificial lake. The ground around it and extending beyond the new site was enclosed in an earth embankment, and this area was then flooded with water to a depth of 27 in., sufficient to float the tank and give it a clearance of 10 in. The water was placed in the tank itself, and by opening the tank valves was emptied quickly into the enclosure to avoid seepage. The tank was finally emptied by pumping.

# The Fascination of York Railway Museum

## Locomotives of Former Days

### By a Railway Engineer

IN the closing years of the 19th century British locomotive design and performance had reached a very interesting and at the same time critical stage. Maximum speeds of 80 m.p.h. and over were for the first time in railway history daily events and train speeds generally had reached a high level that was not improved upon for over 30 years. The engines of this period are naturally of exceptional interest, and fortunately examples of some of the most notable types have been preserved and are now kept in the York Railway Museum. Historic feats of speed, no matter when or where achieved, lose a great deal of their glamour when the engines concerned have long since gone to the scrap heap, and only photographs of them remain; but at York some of these old racers can be studied at leisure, and their graceful lines appreciated from all angles.



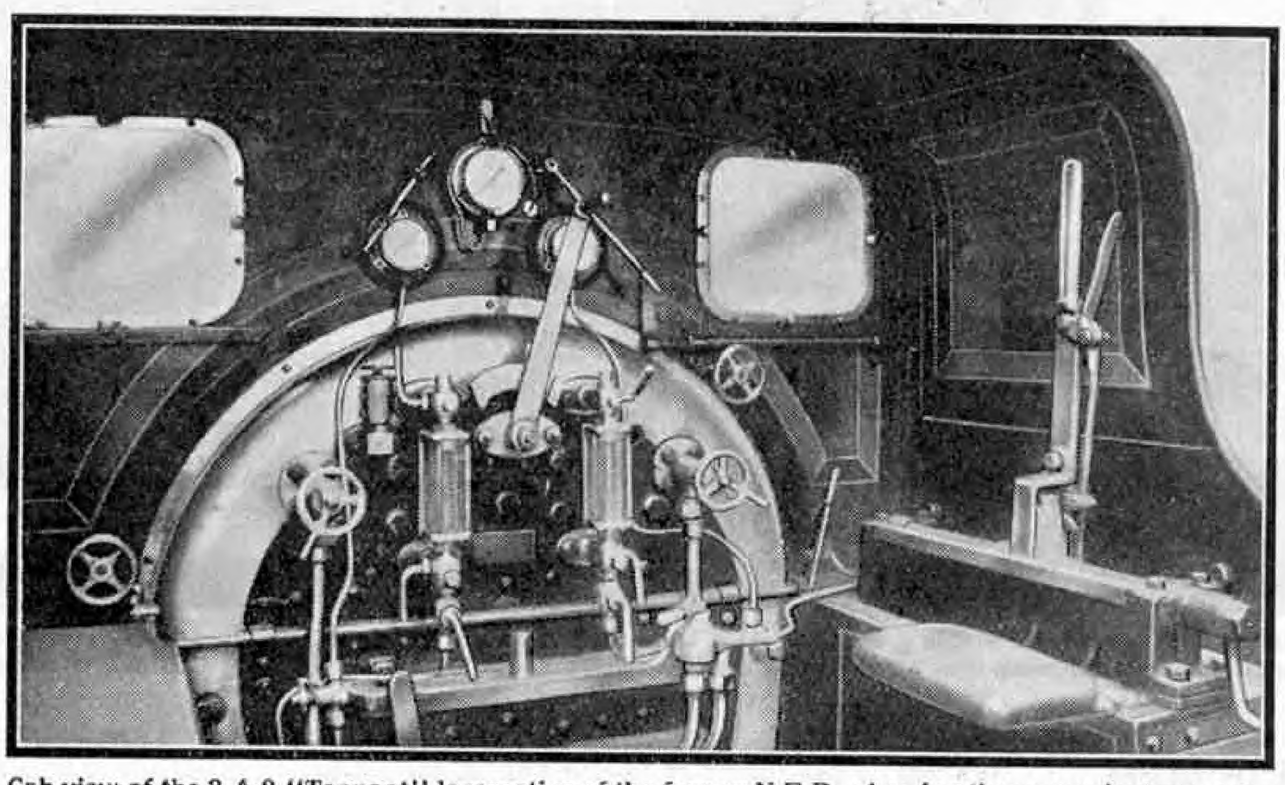
"Columbine," a 2-2-2 "single-wheeler" of the former L.N.W.R. It was the first locomotive to be built at Crewe Works.

In many ways the most striking locomotive of the whole collection is the old Great Northern 8 ft. "single-wheeler." This engine, No. 1, was built by Mr. Patrick Stirling in 1870, and was the pioneer of a type that remained the crack express engine of the G.N.R. for 28 years. It is a remarkable fact that the Great Northern Railway, and its successor the London and North Eastern, have had but three locomotive engineers in the last 65 years, and each, in the early years of his chieftainship, has produced an engine of such outstanding design as to render any further type unnecessary for many years. Mr. Stirling produced the 8 ft. "singles"; Mr. Ivatt, who succeeded him, will always be remembered by the G.N. "Atlantics"; while the fame of Mr. Gresley's "Pacifics" is world wide.

The Stirling "8-footers" are among the most beautiful engines ever built. The huge single driving wheel, the bold sweep of the running plate over the wheel centre, the long domeless boiler, and the beautifully-shaped safety valve cover all combine to give a most elegant appearance at any time; but the sight of one of these engines at speed was a thing never to be forgotten. The footplate arrangements are most interesting. Only one water gauge is provided; the reversing gear is of the notched lever type, but with a very much coarser adjustment than on later Great Northern engines; and the regulator is opened by pulling out horizontally. This pattern was standard on all Great Northern engines with the exception of the Ivatt "Atlantics," and was used also on the earliest types designed by Mr. Gresley. The boiler is quite small, and the look-out ahead, interrupted only by the chimney, is almost as good as that of a motor car.

After 25 years on the hardest express duties came the biggest test of their whole career, the "Race to Aberdeen" in 1895. Rivalry between the equivalents of the present-day "*Aberdonian*" and "*Royal Highlander*," at that time leaving King's Cross and Euston respectively at 8 p.m., grew so intense that in August timetables were scrapped altogether and each train went "all-out" for the Granite City. Throughout the culminating weeks the Stirling 8-footers greatly distinguished themselves by their unvarying excellence; but on the final night, Wednesday, 21st August, the Great Northern achieved the marvellous feat of reaching York, 188.1 miles from London, in 181 minutes. This time is only one minute more than the fastest time ever scheduled between the two cities, that of the "*Scarborough Flyer*" of last summer; but the 1895 time included a two-minute stop at Grantham to change engines. On this wonderful run No. 668 was the engine from London; and she passed Peterborough, 76.4 miles, in 72 minutes, and completed the 105.5 miles to Grantham in 101 minutes. Engines were changed like lightning in a little under two minutes, and with another 8-footer, No. 775, at the head of the train the 82.6 miles on to York were run in 78 minutes. The load on this historic occasion was one of six six-wheeled East Coast Joint coaches and an eight-wheeled sleeping car, a weight of about 140 tons.

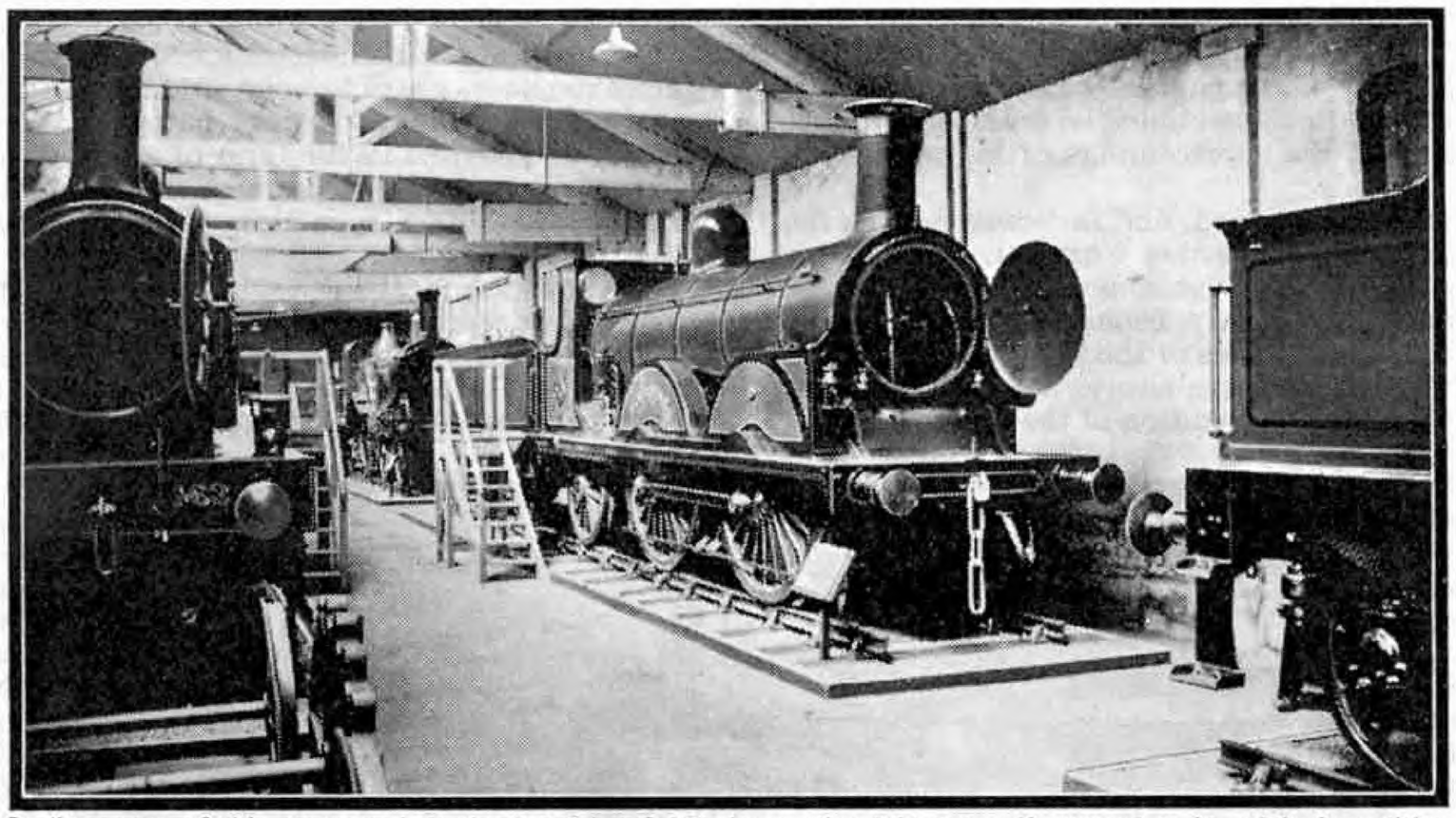
The only other single-wheeler in the museum is a veteran of such hoary antiquity that the Stirling 8-footer seems a modern engine by comparison! This is "*Columbine*," a 2–2–2 of the London and North Western Railway, and the very first engine built at Crewe Works. This "tiny tot" of a locomotive was designed by Francis Trevithick, a son of the famous Richard Trevithick, and was turned out in 1845. At first sight it appears to have a domeless boiler, the only mounting between the chimney and cab being a safety valve column; but on climbing up on to the footplate the dome is discovered—inside the cab! At the time of construction "*Columbine*" was not even fitted with a weatherboard, let alone a cab; and the dome, a big copper geyser-like erection, is mounted over the fire-box. In the light of modern practice the footplate arrangements are singular indeed. The various steam cocks take the form of big brass taps; there is a total absence of gauges, and only the regulator and notched lever reversing gear have any resemblance to modern practice.



Cab view of the 2-4-0 "Tennant" locomotive of the former N.E.R., showing the convenient arrangement of the fittings and the neat finish generally.

The driving wheels are only 6 ft. in diameter, very small for a single-wheeler; but perhaps the most distinctive feature of the engine is the massive double framing that supports the cylinders and leading axle-boxes, and encases the slide bars. This was the

outstanding characteristic of all early Crewe engines, and it was faithfully copied on several of the Scottish lines for many years. Another interesting point is the use of a drop-down smoke-box door. "*Columbine*" remained in active service till 1902, and she has been preserved in the condition of that time. She is painted in the black livery of the L. and N.W.R., though at the time of construction the company's engines were finished in green. Although they are of very great historic interest, these Trevithick singles never achieved any great speeds; the L.N.W.R. engines that proved such formidable rivals of the Stirling 8-footers were the 2-4-0 "Precedents," but although one of these latter engines has been preserved it has not yet been placed in York Museum.



In the centre of this photograph is the 0-4-2 L.B.S.C.R. locomotive "Gladstone," restored to its original condition. On the left is the "Tennant" locomotive.

At the time of the "Race to the North," the London Brighton and South Coast Railway was not exactly distinguished for speed. That was not the fault of the engines, however, and it would be hard to imagine a finer example of 19th century locomotive craftsmanship than No. 214, "*Gladstone*," which represents the company at York. The designer, Mr. William Stroudley, was one of those remarkable men who made every detail of the locomotive a matter of constant study and research, and the "Gladstones" were not only a striking and original design but also embodied many most ingenious details. To a modern observer the most arresting point about the whole engine is its colour—bright yellow ochre. This was known officially as "Stroudley's improved engine green"; and the title alone is sufficient to show that no detail of the engine was too trivial to escape Mr. Stroudley's attention. The wheel arrangement, 0–4–2, is unique as far as express passenger engines are concerned, and another curious feature is the use of inside bearings for the tender wheels. Mr. Stroudley was a great exponent of standardisation and these wheels are interchangeable with the trailing wheels of the engine.

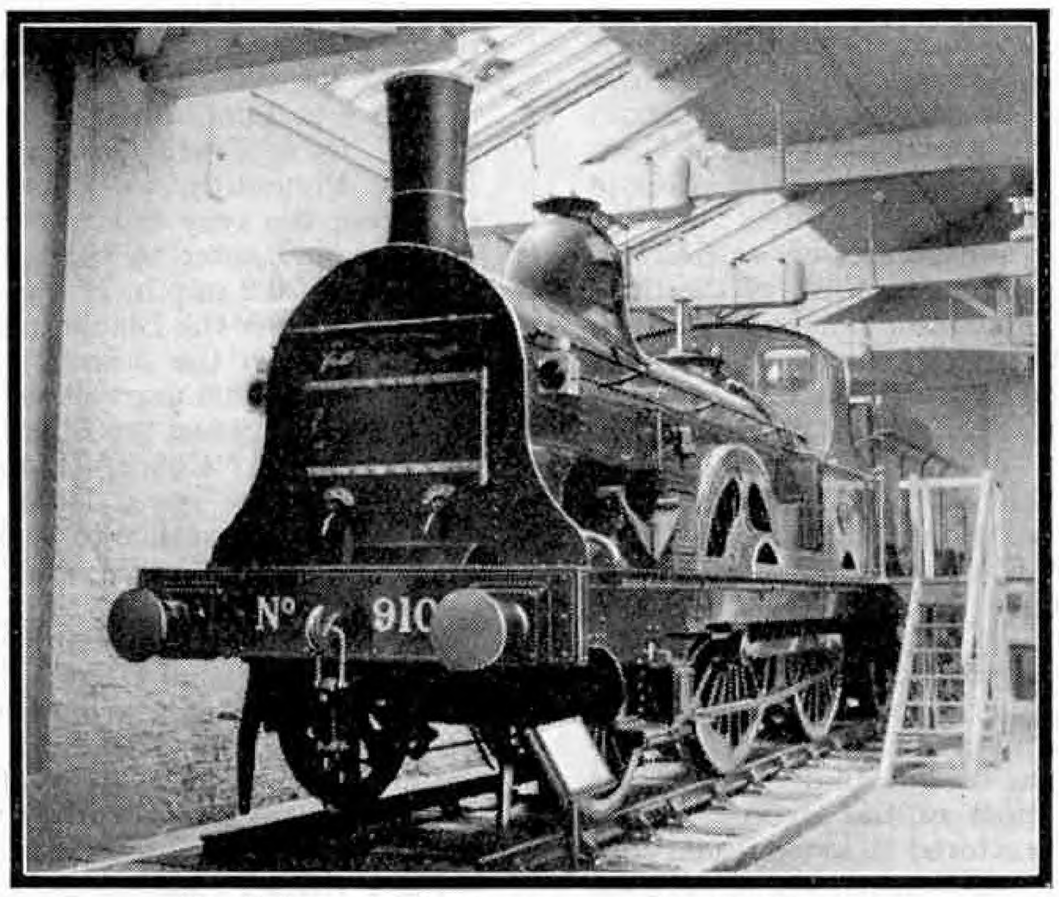
Of the footplate fittings the regulator is of particular note. Under Mr. Stroudley at Brighton there served those equally famous engineers, the brothers Dugald and Peter Drummond, and much of Mr. Stroudley's practice was embodied in the subsequent designs produced by the Drummonds. The 4–6–0 "*Beaufort Castle*," which featured in my footplate run on the Highland Mail, described in the "*M.M.*" for May last, was fitted with an exact replica of "*Gladstone's*" regulator. The latter engine is fitted with a speed indicator of a novel and ingenious kind. A small water pump is driven off one of the axles and maintains a level of water in a vertical glass tube in one corner of the cab; as the speed increases, the quicker working of the pump causes the water level to rise in the tube. I was amused to see that the glass was not graduated above 60 m.p.h. Presumably this figure was not supposed to be exceeded, though actually the "Gladstones" were fast engines and regularly attained 75 m.p.h. and over.

One last point illustrates the striking changes that have taken place in locomotive working since 1882, the year "*Gladstone*" was built. Over the regulator are painted the words, "William Love; Driver." At that time every driver had his own engine and no other, and it was only in cases of emergency that man and machine were separated. What a contrast this makes with modern practice when, on the L.M.S.R. for example, a "Royal Scot" class engine may be handled by four different crews in the course of a single day's work!

In the 19th century tank engines very rarely appeared on fast trains, and so there are no records of speed exploits to compare with those of their brilliant modern counterparts, such as the L.M.S.R. 2–6–4s and the Great Western 2–6–2s. The only tank engine in the Museum has quite a remarkable history all the same. This locomotive, No. 66 "*Aerolite*," belonged to the North Eastern Railway and was built as long ago as 1851; at that time it was a 2–2–2 with outside cylinders and two water tanks, one below the forward end of the boiler and the other under the coal bunker. In 1869, and again in 1886, the engine was successively modernised, but its present condition dates from 1907, when a very interesting rebuilding took place.

The cylinders had been moved to a position inside the frames in 1869, and in 1886 the old well tanks had been replaced by side tanks of conventional pattern, but throughout the first 56 years of its existence the engine had remained a 2–2–2 simple. In 1907 the engine was taken out of ordinary service, however, and drafted to work the Chief Mechanical Engineer's private saloon. To enable "*Aerolite*" to make the long runs sometimes necessary on such duty it was fitted with enlarged coal bunkers that in turn necessitated a trailing bogie to carry the increased weight.

The engine thus became a 2–2–4 and at the same time was converted to a 2-cylinder compound on the Worsdell-von Borries system. This system had been used extensively on the North Eastern Railway in the closing years of the 19th century both for express passenger and goods engines; it proved most economical and successful, but with the increasing weight of trains and the limitations imposed on the size of cylinders placed between the frames, the engines proved somewhat inflexible and with heavy trains were sluggish starters. But on such a duty as that of hauling the Chief Mechanical Engineer's saloon the system was ideal. The high pressure cylinder is 13 in. dia., and the low pressure 18½ in. dia., the stroke in each case being 20 in.




The Fletcher 2-4-0 locomotive of the "901" class.

In her present condition "*Aerolite*" is a very pretty little engine, but her principal claim to notoriety is that she is the last English survivor of the Worsdell-von Borries system and also of that rare species, a single-wheeler tank engine. These two unusual features combined make "*Aerolite*" quite a unique locomotive.

Right up to the end of the 19th century the most popular wheel arrangement for British express engines was the 2–4–0, and in York museum there are two very fine examples of the type, both North Eastern locomotives. The older, No. 910, was built in 1875 to the designs of Mr. Edward Fletcher. It has a sturdy, bull-doggy sort of look, while the stove pipe chimney tapering outward from the bottom, the safety valves on the dome, and a highly decorative finish give the engine a most distinctive appearance. The coupled wheels are 7 ft. diameter, in fact the "901s," as the class were known, were racers in every sense of the word. For many years they hauled the Scottish expresses between York and Edinburgh, and in 1888 frequently ran the hilly 57½ miles from Berwick to Edinburgh in less than an hour.

The cabs were quite roomy for the period, but it seems strange nowadays to have the rear coupled wheel splashers extending right inside; their presence considerably restricts the space available

though they make good seats. The fittings are simple and straightforward, and the engines were always great favourites with the men. One particular point about their design deserves special mention. In order to soften the blast at speed, and reduce fire-throwing to a minimum, Mr. Fletcher fitted the cylinders with exhaust cocks, so that a certain amount of the exhaust steam was allowed to escape directly from the cylinder instead of passing through the blast pipe and up the chimney. It was most successful, and the coal consumption when working the heavy East Coast expresses was little over 25 lb. per mile. The popularity of the engines was such that, when Mr. Fletcher retired, indignation meetings were held all over the system to protest against the shortcomings of his successor's first new type!

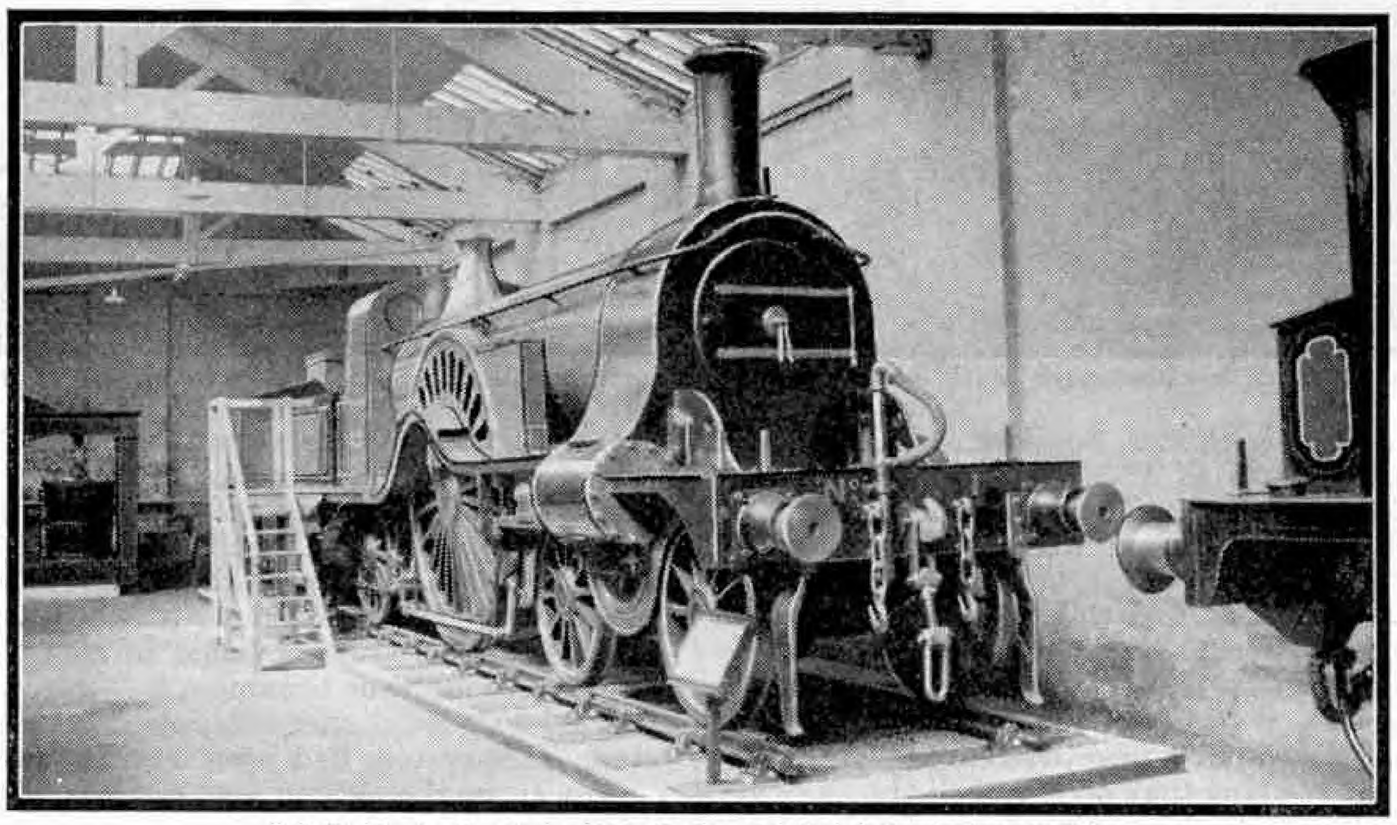
Mr. Fletcher's successor soon resigned, and for some months the North Eastern was without a Locomotive Engineer. During this period however a committee of locomotive men under the chairmanship of the General Manager, Mr. Henry Tennant, was responsible for producing one of the finest examples of the 2–4–0 type that has ever run. The "Tennants," as they have always been known, were technically an enlarged and improved edition of the Fletcher "901" class, but outwardly they are of very much neater appearance. The cab interior is most ornate; the fire-box has a broad polished brass surround, the side sheets are finished to look like wood panelling, and a padded seat is provided for the driver. The reversing gear is a combination of a notched lever and screw, the former being used for large movements such as reversing the engine, and fine adjustment of cut-off obtained with the screw. Double sliding fire-doors are used.

The "Tennants" were not only handsome to look at, but also were magnificent performers on the road. They bore the brunt of the "Race to Edinburgh" in 1888, when *"The Flying Scotsman"* was pitted against the Edinburgh portion of what is now *"The Royal Scot."* These gallant little 2–4–0s made the 80-mile run from York to Newcastle in 79 to 82 minutes as a regular event with loads of about 140 tons. An even finer feat was to cover the 124 miles from Newcastle to Edinburgh in 127 minutes; this was a wonderful effort in view of the heavy climbing involved north of the Border. Standing on the footplate, looking through the big square window with slightly closed eyes, it is not difficult to recapture something of the thrill and excitement of the race—the little engine rolling and pitching like a live thing; driver and fireman keyed up to the highest pitch, and behind them a train of six-wheeled non-corridor coaches. It seems incredible to us to-day that at the time of the 1888 race the "Scotsman" was booked to stay 20 minutes at York for lunch; one can quite imagine with what impatience that stop was regarded! The "Tennants" also did good work in the early days of the 1895 "Race to Aberdeen," but as the speed increased the latest Worsdell 4–4–0s were used. The 2–4–0s regularly attained 75 m.p.h. and touched 83 and 84 in the 1888 race.

The greatest racer of all in the distinguished company in York Museum, the Great Western 4–4–0 *"City of Truro,"* is really a 20th century engine. She was built in 1903 and provides a most interesting connecting link between types such as the "Tennant" 2–4–0 and modern locomotive practice. Unlike most of the engines in the Museum, *"City of Truro"* has not been restored to her original condition; but although she looks extremely modern compared with the others, the changes are not so great as might at first be imagined. The boiler has been fitted with top-feed apparatus on the safety valve casing, the familiar Great Western chimney with its copper cap has replaced the original tapered pattern, and a Swindon superheater has been added. The exterior finish is just as decorative, perhaps even more so than the original. The engine was withdrawn from service in 1931, and at that time all the company's engines carried the full name "Great Western" on the tender; the recent change to a small monogram consisting of the letters GWR is a reversion to the practice in vogue when *"City of Truro"* was built, though the three initials were then interwoven in a series of artistic curves, strongly contrasting with the plain block letters of to-day.

The footplate arrangements are practically unaltered, and what is more remarkable, little change has taken place in Great Western practice since the engine was built; but for the absence of the audible cab signalling apparatus you might be standing on the footplate of a "Castle" or a "King." *"City of Truro"* is the only engine in the museum to have the actual percentages of cut-off marked on the reversing gear, though it is interesting to note that nothing lower than 25 per cent. appears. Double sliding fire-doors are used, operated by a mechanism exactly the same as that adopted on the L.M.S.R. 4–6–2s of the "Princess Royal" class; *"City of Truro"* has cast iron doors working in a plain slide, whereas in the recent L.M.S.R. engines the doors are of fire-clay and run on rollers. The regulator is of the standard Great Western pattern, wherein oil is fed into the steam and carried in the form of a fine spray to the cylinders and valves. By means of a link motion, operated by a roller working in a cam slot on the regulator quadrant plate, oil is only fed into the steam when the regulator is open.

Perhaps the most not ceable difference between *"City of Truro"* and the other eng nes in the museum is in the cab look-out. One narrow w ndow on each side gives only a very restricted view on either side of the Belpaire fire-box; it is not only a poor view compared with the other engines at York, but also in comparison with big modern locomotives. The cab does not extend to anything like the full extent permitted by the loading gauge, however, and it is only by making the cab as wide as possible that engines with boilers of the size of *"Cock o' the North"* and *"The Princess Royal"* have been given such splendid look-outs.



G.N.R. No. 1, the first of the famous Stirling 8 ft. single-wheelers

*"City of Truro"* achieved everlasting fame by attaining the tremendous speed of 102.3 m.p.h. while hauling an Ocean Mail special from Plymouth to Paddington. This amazing feat took place on 9th May 1904 and was the culminating effort of a series of runs that put the 1895 "Race to the North" completely in the shade. In 1904 eastbound Transatlantic liners began calling at Plymouth, and the Great Western with the mails, and the London and South Western with the passengers, indulged in a race to London of the most thrilling kind imaginable. On 9th May *"City of Truro"* hauling a load of 148 tons ran from Millbay Docks, Plymouth, to Bristol, 127.8 miles in 123 min. 19 sec., including the very heavy grades of the South Devon line; the 75 miles from Exeter to Bristol were covered in 64 min. 17 sec., an average of 70.2 m.p.h. It was however after the train had mounted the ascent over the Blackdown hills that the pace became so exceptional, and on the descent to Taunton *"City of Truro"* reached 102.3 m.p.h. This marvellous achievement was not surpassed until 31 years later, when the L.N.E.R. Super-Pacific *"Papyrus"* attained 108 m.p.h. On *"City of Truro's"* part it was no brief spurt either, for the average speed from Whiteball summit right through to Bedminster, a distance of 54.5 miles, was 74 8 m.p.h.! It is amusing that this feat of speed was kept a secret for years, for fear of alarming the public!

Not the least of the many admirers of these grand old engines are the local drivers and firemen. Naturally to them the Great Northern and North Eastern locomotives appeal most, for many top link drivers of to-day have fired on the "Tennants" and Stirling 8-footers and retain a great affection for their old steeds; but the strangers also come in for their full share of attention. The Museum is quite close to the south locomotive yard, and on one of my earliest visits I found a Sheffield driver studying *"City of Truro"* intently. I have yet to meet the locomotive man who, whether on duty or off, was not ready to talk "shop," and in conversation with him I learned of the respect in which *"City of Truro"* is held among northern enginemen. It is not to be wondered at, and especially as at that time her epic feat had not been surpassed. This driver's interest was not merely that of a sightseer, for he was keenly critical of certain details, and to drive his points home more forcibly he took me outside and showed me the features of his own engine, an early G.C. Robinson 4–4–0, that he considered superior to those of the famous Great Western racer. The black livery and travel-stained appearance of the Great Central engine contrasted strongly with the superb finish and spotless cleanliness that is not the least attractive feature of the veterans inside. Thus in every way the York Railway Museum is a veritable treasure house of British locomotive history.

# The Wimbledon "Fly-Over"

## Improving the Approach to Waterloo Station

ON Sunday 17th May last the S.R. brought into use the greater part of a scheme designed to improve the approach to Waterloo Station. This included a "fly-over" line near Wimbledon and various improvements in the track outside Waterloo, together with colour-light signalling between Malden and Vauxhall. The change-over is yet another of those apparently overnight transformations that seem to have become almost second nature to the S.R. engineering and signalling staffs during the past few years.

The policy of suburban electrification that was started on this Western Section of the S.R. by the former L.S.W.R. in 1915 has given rise to an increase in traffic; and this, with the necessity for providing for future developments, has made necessary the improvement of facilities for handling trains into and out of Waterloo. Some 200 more trains are being operated in and out of Waterloo during a normal 24 hours than in 1925, and until the new arrangements were completed this was being done over the same layout of lines as existed 10 years ago, and with ordinary normally-operated signalling except at Clapham and West London Junctions, where power operation had been in use for 25 years.

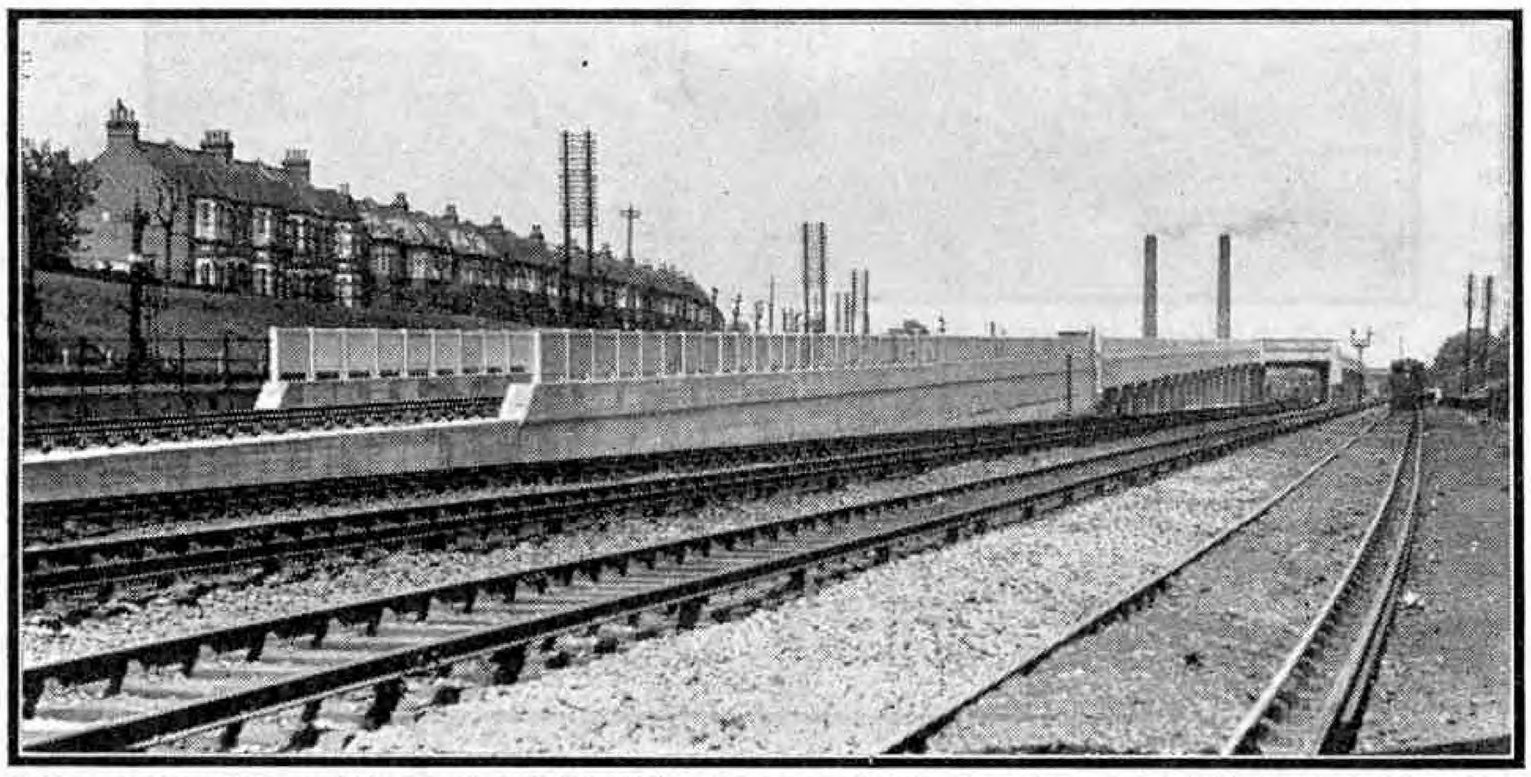
On the former L.S.W.R., now the Western Section of the S.R., it has long been the principle, where separate pairs of fast and slow roads are provided, to keep the fast lines in the centre. Ordinarily this is quite convenient, and it is easy to arrange connections between fast and slow roads in the same direction so that trains can be transferred from one to the other without difficulty. A disadvantage is that on reaching a terminus the slow trains have to be dealt with at platforms relatively far apart—an inconvenient arrangement—unless the track connections approaching the station allow the trains to and from the slow lines to be dealt with on adjacent roads. When this is effected by means of ordinary surface connections, trains from one or other of the slow lines either on entering or when leaving the station have to cross the fast lines.

This is exactly what was happening at Waterloo. Stopping electric trains going up to London had to cross the paths of the up and down steam and electric fast trains just outside the station. Another point of importance was that main line trains had become so long that they could only be accommodated at certain platforms; and on leaving Waterloo they had to cross all the up lines between there and Vauxhall, thus adding to the possibilities of delay to other trains. Again, only 10 platforms were available for main line trains, whereas 16 were really needed in order to permit of the smooth conduct of traffic.

It was therefore decided to take the bold step of altering the disposition of the running lines from a convenient point inward to Waterloo, and to effect alterations in the various track connections outside the terminus to conform with the new arrangements. The new scheme prevents up slow trains delaying the main line ones. It also provides the 16 platforms at Waterloo required by main line trains and reduces delays caused to up fast trains by those departing. In order to obtain the fullest benefit from the new track conditions, the colour-light system of signalling, recognised as the speediest method of moving the traffic through congested areas, is being installed all the way between Waterloo and Hampton Court Junction, but Waterloo Station section will not be completed until Autumn.

A point near Wimbledon was selected as the spot at which the change-over of the lines was to be effected in order to bring the up and down local lines together. To prevent delay to the fast trains, the up local line is carried over them by means of a fly-over, or viaduct with inclined approaches. The illustration on this page shows the commencement of the approach looking in the direction of Waterloo, the oblique crossing over the fast lines, and part of the downward slope beyond. From left to right the tracks in the foreground are up local, up fast, down fast and down local; those beyond the fly-over are the up fast, down fast, up local and down local respectively.

It was in connection with this part of the work that troubles occasioned by the weather challenged the resources of the engineers, and added to the usual difficulties met with on transformations of this kind that have to be carried out without undue interference to traffic. Work on the fly-over, which is a steel and concrete structure, commenced last September. It will be recalled what severe weather was experienced during last winter. Frost hindered the making of concrete, so that fires had to be maintained round the concrete mixers and round the heaps of cement and sand; rain constantly flooded the holes dug for the foundations, which had to be pumped dry before work could proceed again; and fog also impeded progress. By hard and constant endeavour day and night the structure was completed, however, and it was brought into use on the scheduled date. Any delay would have seriously affected the conduct of the traffic in and out of Waterloo.



A general view of the new "fly-over" near Wimbledon by means of which the up local line is led over the two fast lines. It incorporates 850 tons of steel encased in 8,000 cu. yds. of concrete. Photograph by courtesy of the S.R.

The final episode in this mighty effort occurred in the small hours of Sunday morning 17th May. From 1 a.m. till 7 a.m. Waterloo Station was closed for traffic, and during this time normal local services were covered by substitute buses. Victoria became the temporary terminus of Southampton and Salisbury trains, and the starting point for the important newspaper trains that usually depart from Waterloo. During this period of six hours track was slewed and lifted to make the final connections of the existing roads with the new fly-over line; the mechanical system of signalling was replaced by colour-light signals; and the improved layout outside Waterloo was finally completed. The alterations had already necessitated the closing of platforms Nos. 1 to 3 for 10 days, and Nos. 4, 5 and 6 also were out of commission from 6 p.m. on the previous Friday, 15th May. The new track layout had been put together at Mitcham, every piece being marked; and it was then dismantled, ready for the final assembly of the components in their destined position, and their connection to the existing tracks at Waterloo.

The colour-light signals are mostly of the three-aspect and four-aspect types. As compared with the mechanical system previously in use they permit of the reduction in the headway between trains from 4 min. to 2½ min., and in some instances even to 2 min. The new system incorporates certain notable features differing from those of previous S.R. installations. Instead of having separate "splitting" signals for each route at running turn-outs and crossovers, one signal only is now used with a route indicator. This combination avoids the need for many individual signals for which it would be difficult to find room, and also simplifies the driver's task.

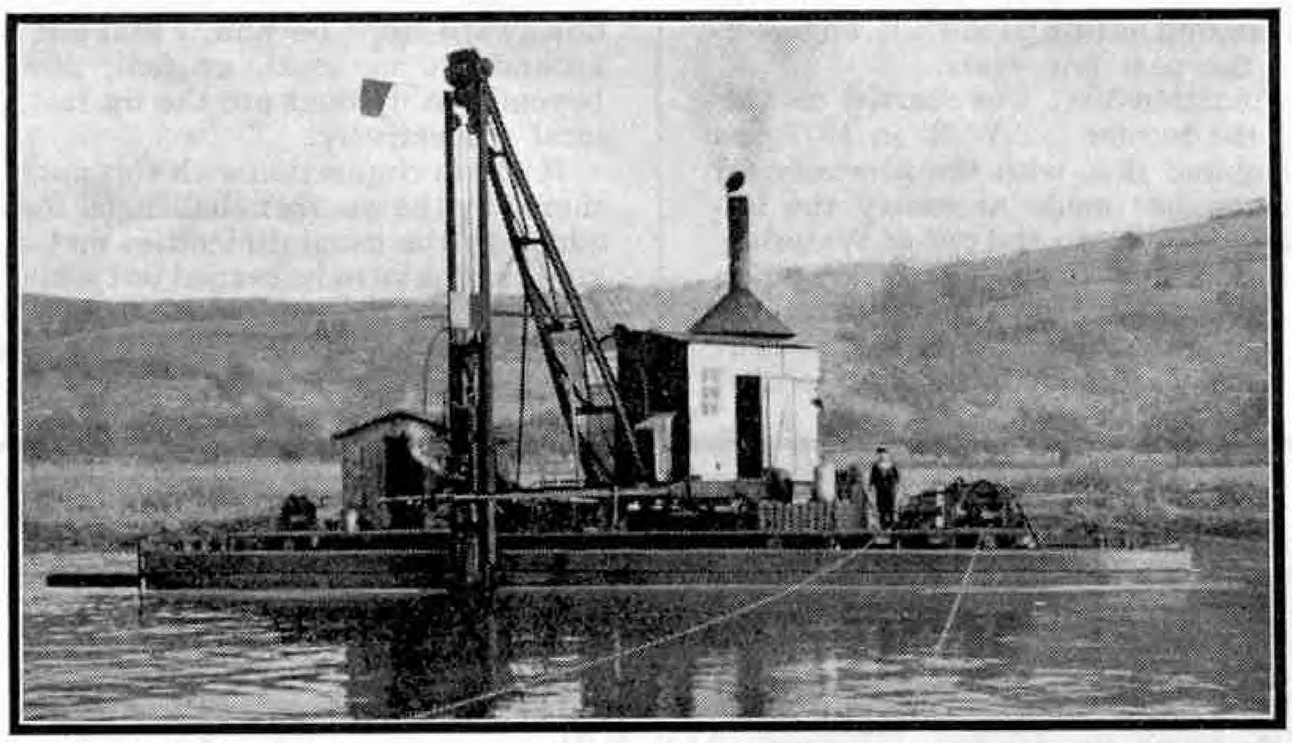
Shunting signals are of special interest in that they consist of white enamelled discs having a red horizontal bar across them. The disc of one of these signals is moved so that the bar is sloped at 45 deg. when the road is clear. They display no lights, but each has a flood-lighting attachment that makes the position of the bar visible at night.

# Excavating Under Water

## Removing Rock from River Beds

By H. F. Kutschbach

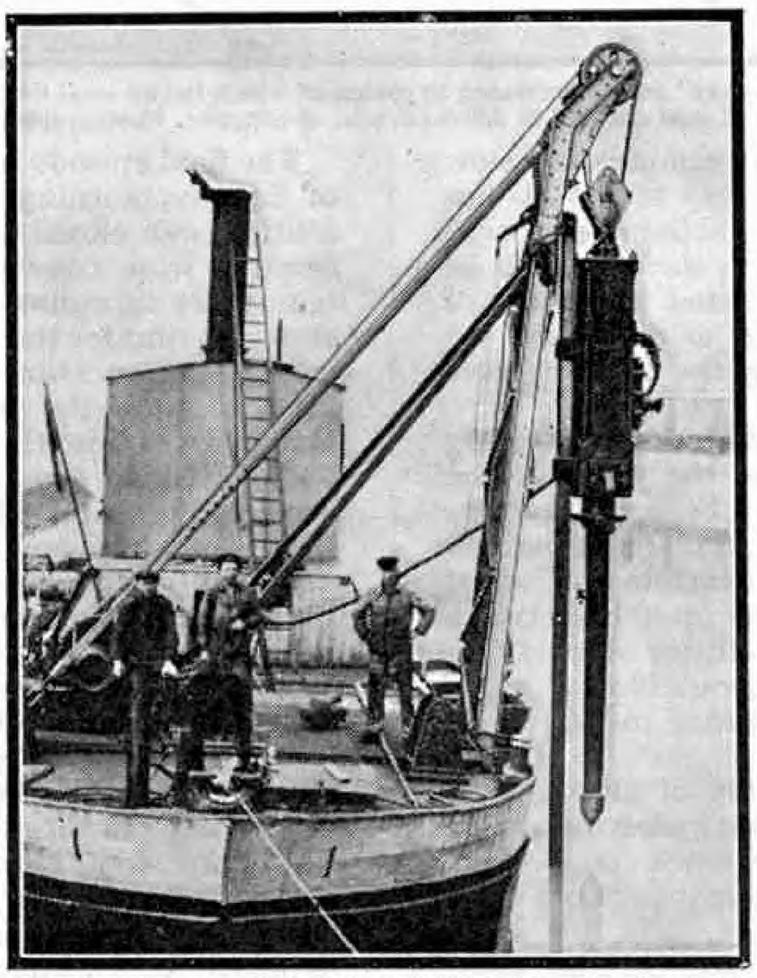
IF the dredging operations now carried on in most of the important trade rivers and harbours of the world were suspended, many of these waterways would soon become unnavigable to any but the smallest vessels, for the vast quantities of sand and silt carried in from the sea by each tide and deposited on the bed of the waterways would rapidly reduce the depth of water available for shipping. Constant and efficient dredging is a necessity in nearly every river and harbour of consequence to trade, and many interesting vessels and implements have been introduced to perform this work. The design of these dredging appliances is governed by the depth of water in which it is necessary to work, and the kind of material that has to be removed.



The German rock-breaking vessel described in the accompanying article, at work in shallow water.

Where the bottom is of a sandy or muddy nature, bucket or suction type dredgers are usually employed. The bucket dredger is a very old form of dredging vessel, the first of its kind being built and launched at Hull in 1778. The name of the inventor is not known, and the dredger itself was crude and primitive. It was fitted with 11 buckets, and the motive power was provided by two horses, which rotated a pair of horizontal beams on the deck of the dredger. The machine was able to work in 14 ft. of water and its output was about 30 tons per hour.

Some years later about the end of the 18th century, steam power was applied to dredging, the engine for the first steam-driven dredger being constructed by James Watt. This was a double-acting engine with a cylinder 18 in. in diameter by 16 in. stroke, and steam was applied at a pressure of from 5 lb. to 10 lb. per sq. in. The oak hull of the vessel was 60 ft. in length and 21 ft. in breadth, and the dredger could work at a maximum depth of 18 ft. A splendid proof of the excellence and durability of the workmanship of the men who built this vessel and engine is provided by the fact that the dredger was in use in the River Tay until 1905.



The rock-splitting tool and power cylinder suspended from the jib of the winch hoist. The tool guide post can be seen near the side of the vessel extending into the water.

During the last 50 years considerable improvements have been made to this class of dredgers in order to increase their efficiency and speed of working, and to-day many of the larger dredgers of this kind are capable of removing up to 1,000 cu. yds. of spoil per hour. In this type of vessel there is an opening in the bottom through which passes a girder that is suspended from a central superstructure and is pivoted at its upper end. The other end of the girder can be lowered down to the bed of the river to be dredged. At each end of the girder there is a heavy roller, round which passes an endless chain bearing at regular intervals metal scoops or buckets. These scoops are fitted with a steel cutting edge, and when the dredger is in operation the chain is set in motion and the scoops dig into the bed of the river, fill themselves, and then return along the upper side of the girder. On reaching the top of the girder the scoops tip over and discharge their contents either into holds in the dredging vessel itself or into barges moored alongside. In some instances means are provided for discharging the excavated material ashore by driving it through floating pipelines by means of powerful pumps.

Suction dredgers do not scoop up material from the river bed like bucket machines, but are provided with powerful pumps that suck up the spoil through long pipes. The pipes are pivotally mounted so that they can be lowered to the river bed.

The work of the pump is often assisted by a rotary cutter, which breaks up the material before this is drawn into the suction pipe. The cutter consists of a series of blades mounted on a rotating shaft, and means are provided for raising or lowering the cutter to work at different depths according to the depth of the bed that is being dredged.

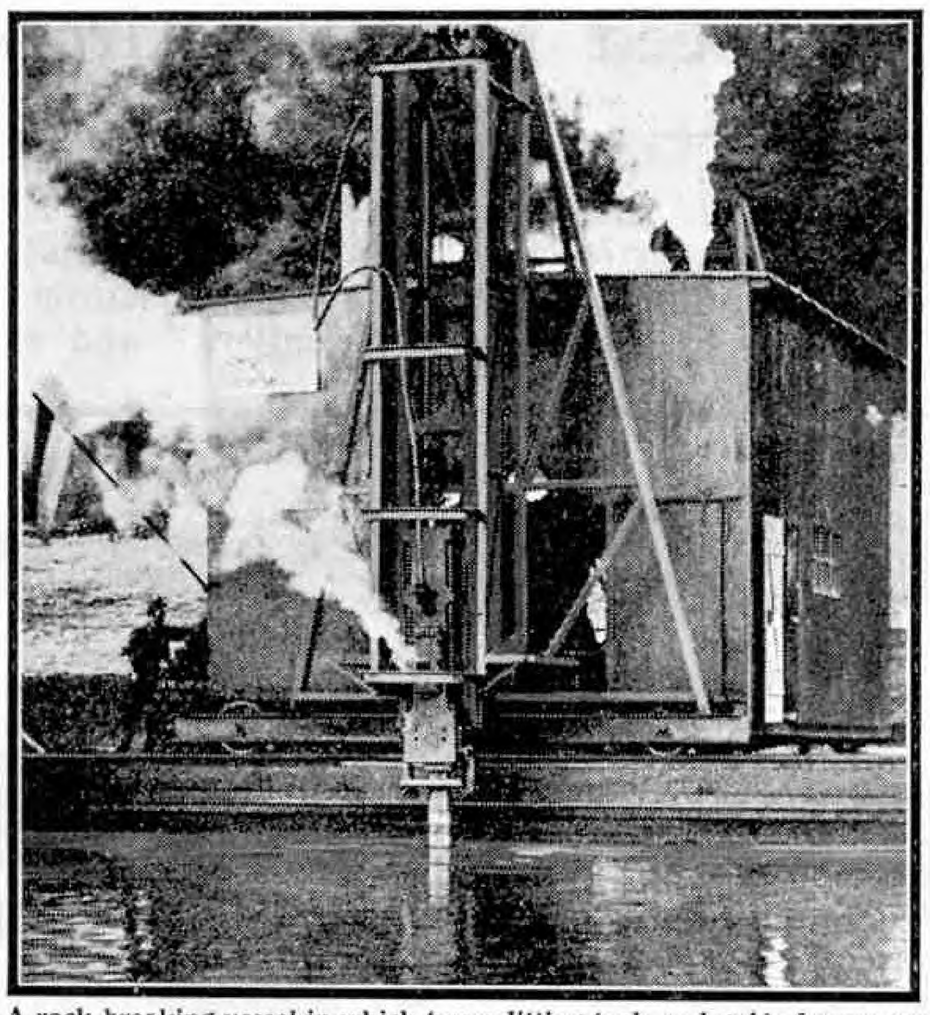
A good example of the work done by large suction dredgers is provided by the great vessels employed to dredge the Bar at the mouth of the River Mersey. Dredging commenced there in 1890, when the depth of water at the Bar at low water of spring tides was only 11 ft.; and the operations have been so successful that under the same conditions there is now a depth of 25 ft.

Dredging has been carried on constantly over an area measuring about 8,000 ft. by 2,000 ft., the latter being the average width of the buoyed channel used by all the ships entering or leaving the Mersey. The material dredged includes both fine and coarse sand and mud.

One of the two largest dredgers employed on the work is the "*Hilbre Island*," a vessel 330 ft. in length and 54 ft. in width. Its powerful pumping machinery is capable of removing 3,500 tons of sand in 50 minutes from a depth of 70 ft. The removed material is stored in huge hoppers aboard the dredger itself, the hoppers having a total capacity of 70,000 cu. ft.

Bucket, suction and grab type dredgers were described in the "*M.M.*" for June 1935, and they are in common use all over the world for deepening and maintaining waterways where the bottom is of a sandy or muddy nature. The beds of many rivers and harbours, however, are composed of solid rock, and when it is desired to deepen such waterways or to remove dangerous rocks other methods have to be employed.

Sometimes the work is carried out by divers operating from small boats. The divers are equipped with rock-splitting implements and blasting apparatus, and under favourable conditions quite satisfactory results are obtained. Owing to its slow nature, however, the process is very costly, and with the object of providing a cheaper and more efficient method of doing this work special rock-splitting and removing vessels have been introduced.



A rock-breaking vessel in which two splitting tools and guide frames are attached to a superstructure that is arranged to travel on rails laid along the deck. The tools operate one on each side of the vessel.

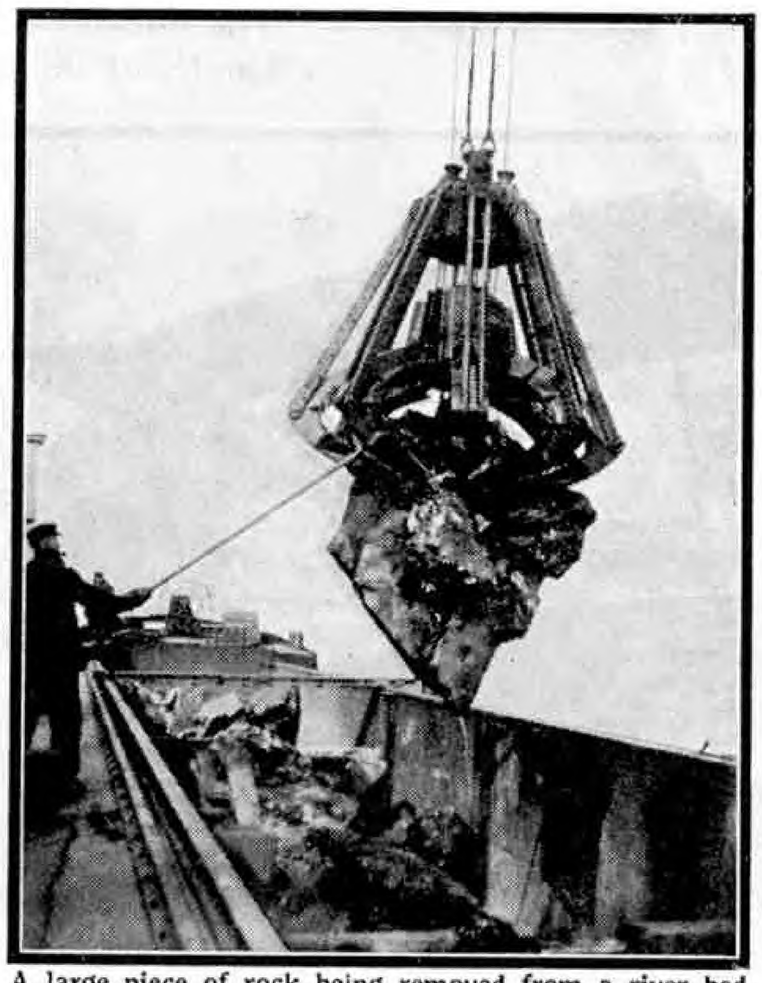
The rock-breaking device with which these vessels are equipped has been developed from the ordinary pile driver, and consists of a cylinder inside which works a reciprocating piston or ram that applies a hammering action to the shaft of a stout steel rock-breaking tool of special shape. The tool is held in a retaining device that prevents it from falling out of contact with the piston, and the whole of this apparatus is suspended over the ship's side by means of wire ropes that pass over a pulley at the head of a hinged jib, and are then wound round the drum of a steam or compressed-air driven winch mounted on the deck of the vessel.

The vessel travels to the scene of operations under its own power, and is there anchored and the rock-breaking appliance lowered on to the rocks. If the waterway is shallow the cylinder of the rock-breaking device may not be completely submerged, and in this case it can be operated by steam power. When the water is deep, however, and the whole of the rock breaker, including the cylinder, is completely submerged, steam power is useless owing to difficulties caused by condensation, and the piston is then operated by compressed air, which is led to the cylinder through a flexible pipe. When the power is turned on, the piston hammers on the splitting tool, forcing it downward into the rock and gradually splitting this apart into pieces convenient for removal.

In order to prevent the tool from skidding off the rock while in action a guide is provided. This consists of a long vertical pillar that is attached at its upper end to the jib, and which may be extended by a further pillar when working in deep water. Brackets are provided on the cylinder of the splitting tool, and these encircle the guide post as shown in the illustration at the foot of the opposite page.

The winch for lowering the cylinder and splitting tool to the correct working level may be driven by either steam or compressed air, and the jib and guide post can be slewed to enable the splitting tool to be moved from place to place without moving the entire vessel.

After the rock has been broken, the next thing to be done is to bring up the boulders out of the water, and sometimes this is carried out by what is known as a "Polyp" grab. This has eight articulated arms and claws, which in action operate very like the claws of a crab, and are able to grip rocks of various sizes and shapes. The pointed arms rummage their way into the split rocks and boulders in such a manner that a good haul is always obtained, and as the arms have quite a lot of sideplay in their joints, and can incline themselves sideways when resistance is encountered in grabbing, the device is very flexible and capable of adapting itself to awkward situations. If one of the arms encounters a difficult obstacle when grabbing, it can not only slide up or down off it, but can also get round it sideways, without in any way affecting the movements of the other arms. Thus the grab adjusts its arms like human fingers in accordance with the job on hand. It is therefore unnecessary to provide the grab with guides, an advantage of great importance in dredging under water when the material to be dredged is out of sight. The "Polyp" is lowered on to the heap of broken rock lying at the bottom of the river by means of a crane mounted either on the rock-breaking vessel itself or on a separate pontoon or barge.



A large piece of rock being removed from a river bed by a "Polyp" grab.

The illustration at the foot of this page shows the new grab in action and explains how the flexibility of its arms enables it to hold even the most irregularly shaped rocks.

Sometimes a bucket dredger is used to remove the broken rock after the rock-breaking vessel has done its work, and as an instance of this method of working it may be mentioned that a few years ago it was decided to deepen the entrance channel at Blythe on the Northumberland coast, a task that necessitated the removal of a million tons of solid rock, which was over-laid by large boulders. A vessel fitted with rock-breaking apparatus, working on a somewhat similar principle to that already described, was brought into use to break up the rock and afterwards a bucket dredger was set to work to remove the boulders. By this method 250 tons of rock were dredged per hour.

# British Single-Seater Fighters

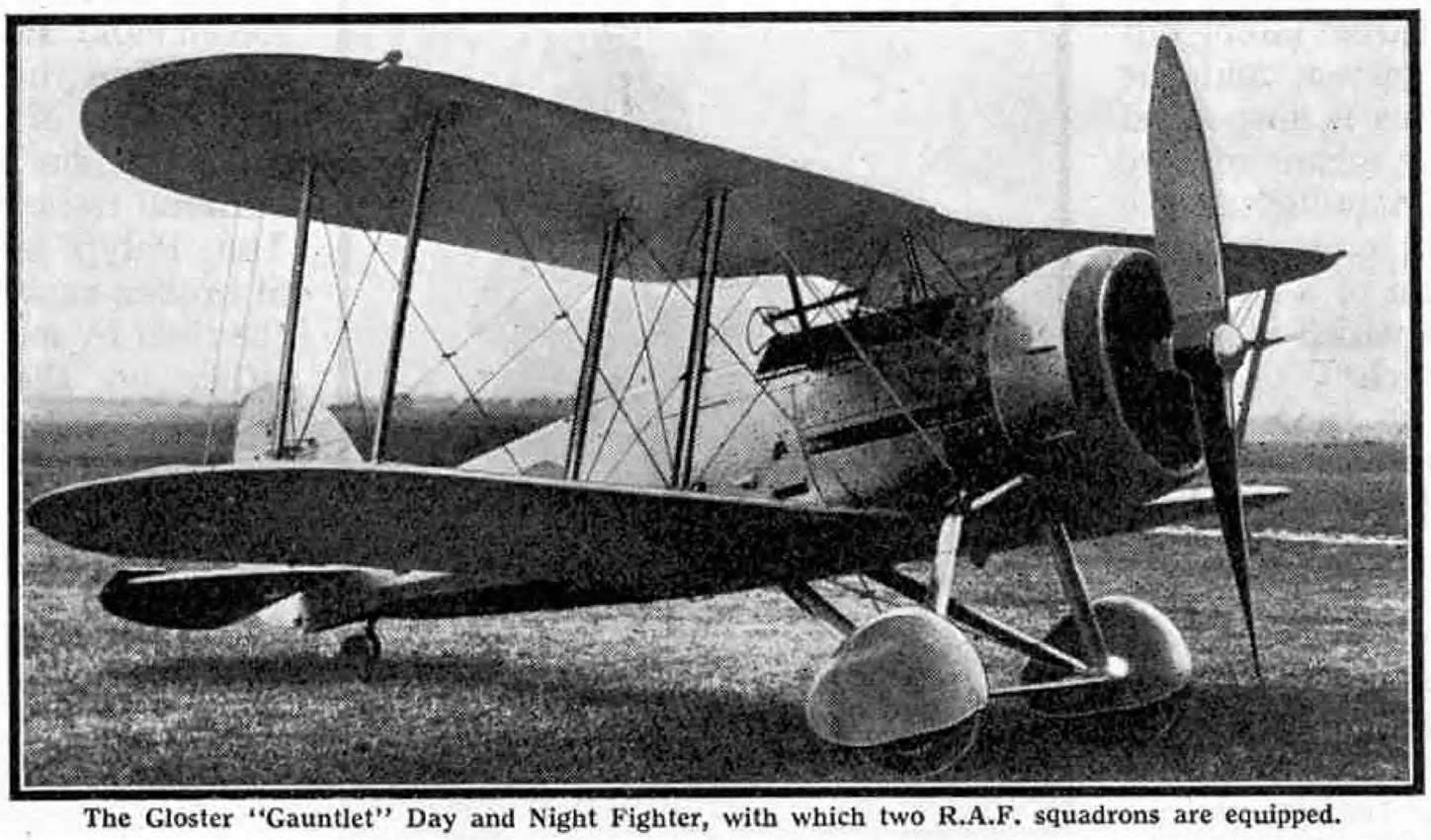
## High-Speed Military Aircraft

THE various types of military aircraft are all of interest, as each has been designed to carry out some particular branch of air activity and possesses certain distinctive features of structure and equipment. In many respects the single-seater fighter is the most interesting of these types. Bombing and reconnaissance work call for the highest skill and the coolest judgment, but these qualities are required in the highest degree by the pilots of fighting machines, who must seek out combat, and fight for the protection of slower and more vulnerable machines engaged on other duties. During the War the fighting squadrons of the R.A.F. were chiefly employed in the protection of machines occupied in bombing and reconnaissance work, but an equally important part of their duties was to keep off marauding enemy aircraft and to attack the machines from which the fire of the enemy's artillery was directed.



The Gloster "Gladiator" General Purpose Fighter. The photographs on this page are reproduced by courtesy of "Flight."

The end of the War did not put a stop to the development of fighting aeroplanes. The tendency in these has been to keep to practically the same overall measurements, but to increase the amount of military equipment carried and to fit larger tanks in order that the machines should be capable of remaining in the air for longer periods. The additional weight that this extra equipment involves has made it necessary to use more powerful engines, and remarkable strides have been made in the efficiency of power units of all types.



The Gloster "Gauntlet" Day and Night Fighter, with which two R.A.F. squadrons are equipped.

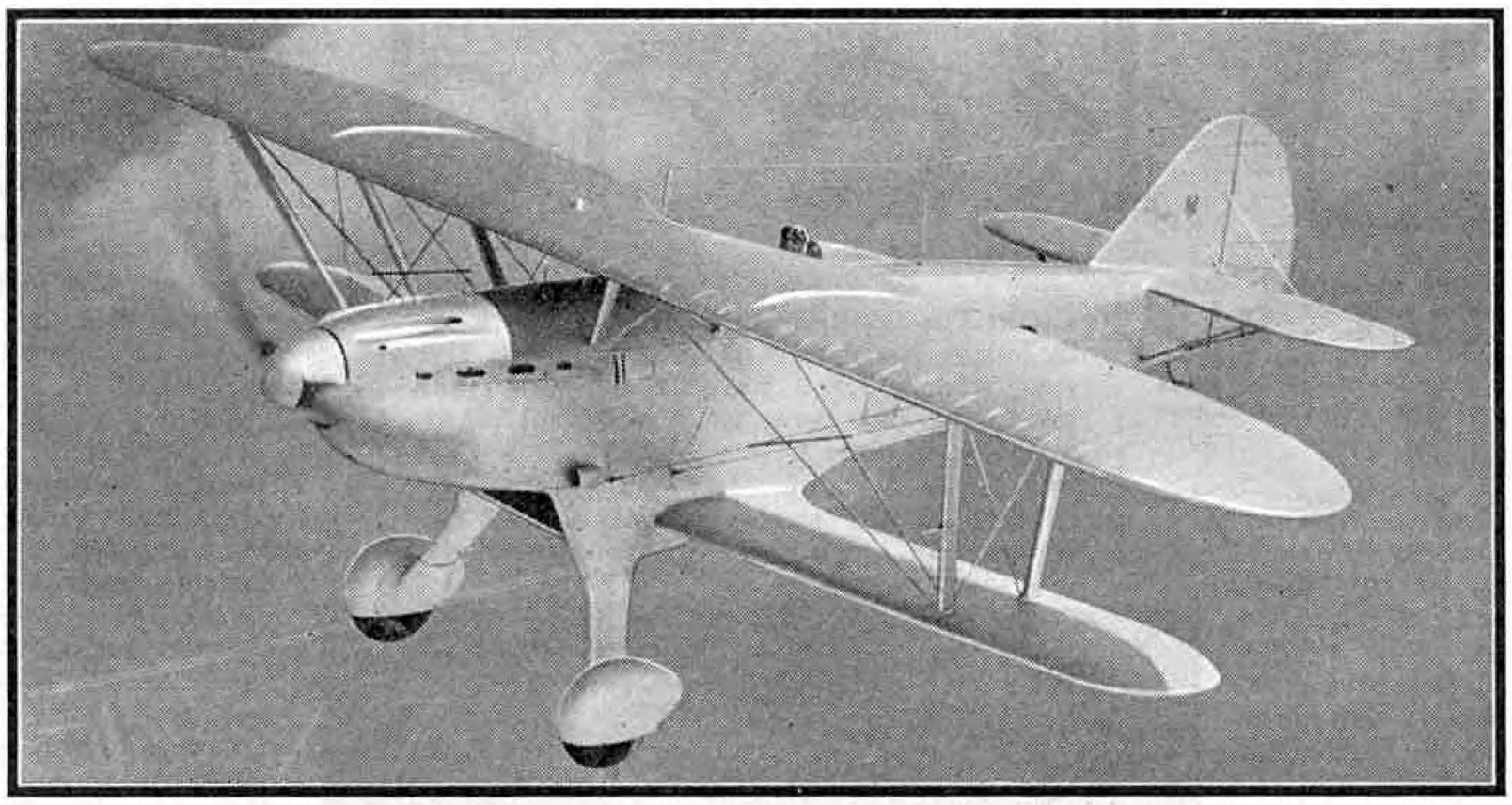
Single-seater fighters are produced in many countries, and the British examples of this class of military aircraft are among the finest in the world. The types at present in use in the R.A.F. include the Gloster "Gauntlet," the Hawker "Fury" and the Bristol "Bulldog." The R.A.F. expansion programme now being carried out has provided an opportunity for acquiring a larger number of machines of certain types and of including new ones. For instance, a second squadron has recently been equipped with "Gauntlets," and several "Gladiators," the latest production of the Gloster Aircraft Co. Ltd. to be adopted by the R.A.F., have been put into service. Another fine type of British single-seater fighter is the "Firefly" produced by the Fairey Aviation Co. Ltd., Hayes, whose "Gordon" day bomber and "Seal" torpedo-spotter reconnaissance machines are standard service types in the R.A.F. A more recent production of this company is the "Fantome" single-seater fighter. In this article we describe the Gloster "Gauntlet" and "Gladiator," and the two Fairey machines just referred to.

The Gloster "Gauntlet" Mk. I has a span of 23 ft. 9½ in., a length of 26 ft. 6 in., and a height of 10 ft. 2 in. The wings are built up of light steel spars and ribs, with a covering of fabric secured to the wings by a method of "wiring-on" that has been patented by the Gloster company. The framework of the fuselage is also of metal and is oval in section; the forward part is covered with metal panels and the rear part with fabric. The powerful wheel brakes of the undercarriage can be operated either from the control column, or by means of pedals attached to the rudder bar.

The trailing edge of the centre section of the upper wing is cut away to provide adequate clearance for the pilot, as the cockpit is situated beneath this part of the wing. The equipment of the cockpit is very comprehensive, and in addition to the usual navigating instruments and the necessary gun sights and supply of ammunition, it includes night-flying equipment, a wireless transmitter and

receiver, and a supply of oxygen. The two Vickers guns are mounted in troughs, one in each side of the fuselage, and are easily accessible to the pilot. There are also racks from which four 20-lb. bombs can be hung.

A Bristol "Mercury" VI.S engine is fitted in the nose of the fuselage. It is of the radial air-cooled type and develops 605 h.p., which gives the aeroplane a top speed of 230 m.p.h. at 15,800 ft. The "Gauntlet" has a very high rate of climb, as this is essential in a fighting machine, and it can attain an altitude of 10,000 ft. in four minutes, and takes only nine minutes to reach 20,000 ft. The service ceiling is 33,500 ft.



The Fairey "Fantome" in the air, photographed from another machine. Illustration reproduced by courtesy of "The Aeroplane."

A later version, known as the "Gauntlet" Mk. II, differs from the original machine in having the wing spars and rear part of the fuselage of the type embodied in Hawker aircraft. It may be mentioned here that early in 1934 the Gloster company was taken over by Hawker Aircraft Ltd., of which it is now a subsidiary company.

The "Gladiator" has been developed from the "Gauntlet," and although it carries more fuel and equipment it gives a much better performance with the same type of engine. It is very similar to the "Gauntlet" in regard to wings, fuselage and tail unit. The engine is a Bristol "Mercury" IX, and enables the aeroplane, fully loaded, to attain a top speed of 260 m.p.h. at 15,500 ft., which is 30 m.p.h. faster than the "Gauntlet." The fuel tanks are in the fuselage. The all-up, or loaded, weight is 4,400 lb. and although this is 450 lb. more than that of the "Gauntlet" when loaded, the new aeroplane takes only 9 min. 20 sec. to climb to 20,000 ft.

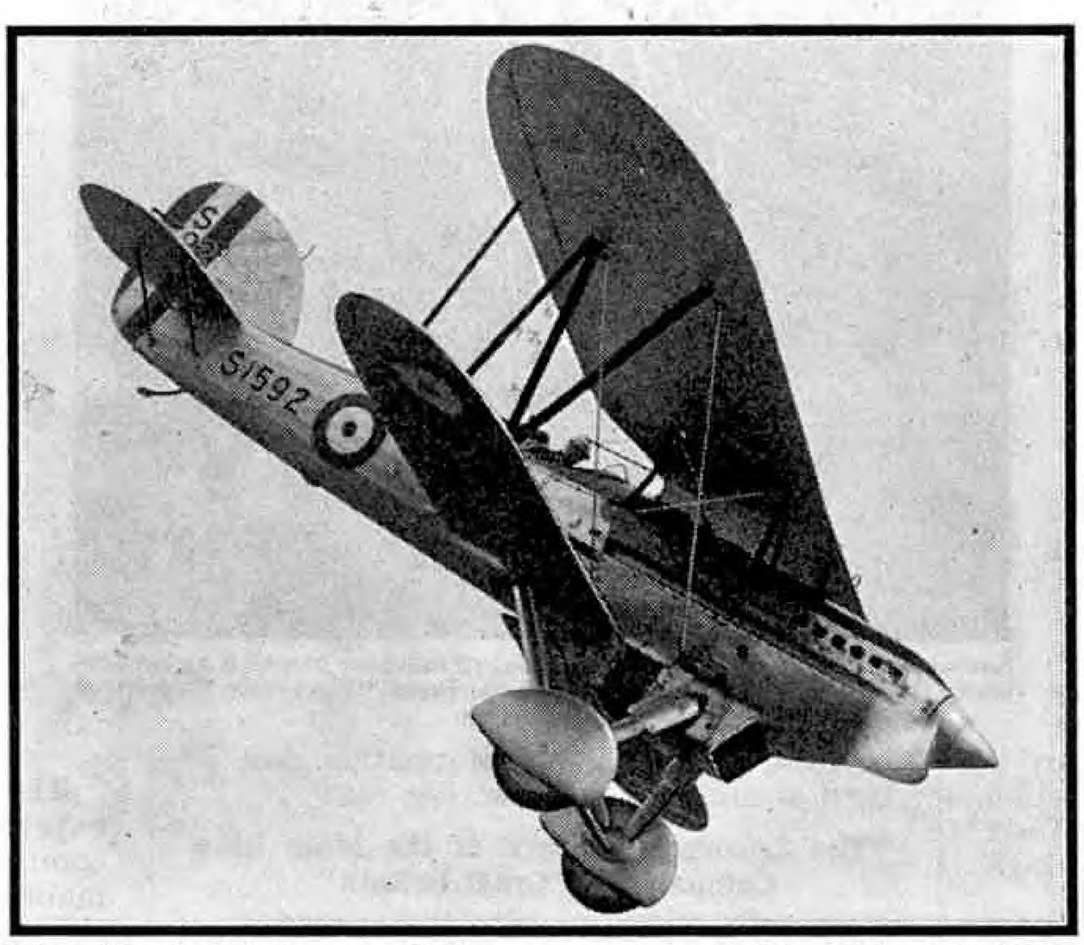
There is no doubt that the "Gladiator" will be a very formidable foe in the air. In addition to being capable of a very high maximum speed and a fast rate of climb, it is armed with four machine guns. Two of these are placed like those of the "Gauntlet" and the other two are mounted below the lower wing, one on each side of the fuselage. The lower guns fire outside the radius of the airscrew.

Many types of British military aircraft have been adopted by the Air Forces of foreign countries. The Fairey "Firefly" single-seater fighter, for instance, is standard equipment in the Belgian Military Air Force, and the machines of this type required for that Force are produced by the Belgian Fairey company.

The "Firefly" has wings of unequal span and therefore is a sesquiplane. Literally a sesquiplane is a machine with one-and-a-half wings; in practice, however, the term is applied to all biplanes in which one wing is shorter than the other. The overall span of this aeroplane is 32 ft., and both wings are built up of metal components and have a fabric covering. The fuselage conforms to the general practice for fighting machines and has a metal framework of oval section. The front part is covered with aluminium cowling that can be removed easily and quickly for inspection of the framework, and the rear portion is, of course, covered with fabric. The well-equipped cockpit for the pilot is just aft of the upper wing.

A Rolls-Royce "Kestrel" engine is employed, and, as the lower photograph on this page shows, is completely covered by the cowling. The engine is of the water-cooled and supercharged type, and the necessary cooling system for it is fitted under the fuselage. The main fuel tanks are in the upper wing.

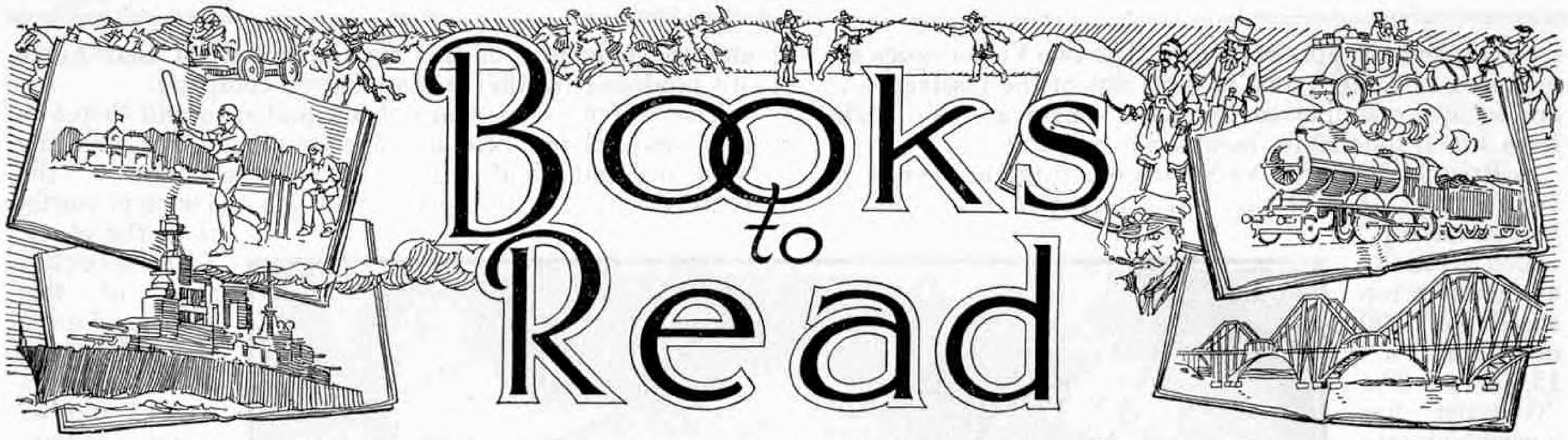
The armament of the "Firefly" consists of two Vickers guns, and these fire in a forward direction through two recesses, one in each side of the long cowling covering the engine.




Fairey "Firefly" single-seater Fighter, as used in the Belgian Military Air Force. Photograph by courtesy of the Fairey Aviation Co. Ltd., Hayes.

Some time ago the Belgian Government organised a competition for single-seater fighters, and aircraft entered were required to have a top speed of at least 248 m.p.h. at 16,400 ft., and to be able to climb to 5,000 ft. in six minutes. One of the aeroplanes designed and built for this competition was the Fairey "Fantome" illustrated in the upper photograph on this page. It is an unequal-span biplane, with the wings slightly staggered, that is, one wing is set a little ahead of the other. The overall span is 36 ft. 6 in., the length is 27 ft. 6½ in., and the height is 9 ft. 2 in. The wings, fuselage and tail unit are built on similar lines to those of the "Firefly," and the pilot's cockpit contains full night-flying equipment.

The armament is of especial interest, as it includes a .78 in. Oerlikon quick-firing gun, which is mounted in the "vee" of the Hispano-Suiza engine and fires through the airscrew boss. There are also four machine guns.




*Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postage on different books varies, but any balance remaining will be refunded.*

### "Electricity"

By W. L. Bragg, Sc.D., F.R.S.
(T. Bell and Sons Ltd. 8/6 net)

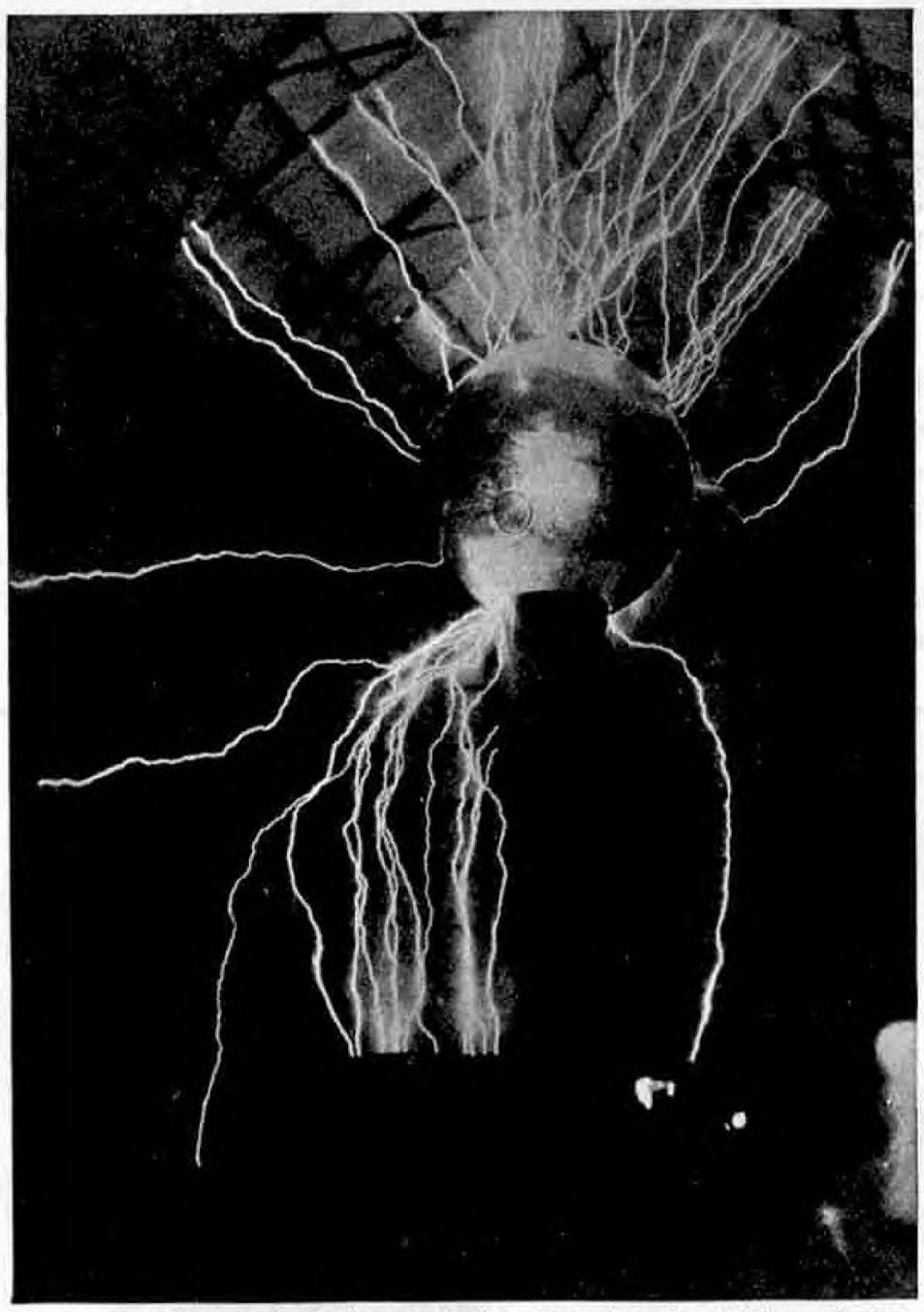
Professor Bragg gave a course of six lectures on electricity at the Royal Institution, London, at Christmas 1934, and has now expanded these lectures into book form. In doing so he has maintained the practical character that distinguishes Royal Institution lectures, which are famous for the number and interest of the experiments performed in them; and the result is a really fine book that will give its readers a complete grasp of electricity and magnetism and an understanding of its use in everyday life.

The author remarks in his preface that "Nature has not prepared us to study electricity." We are able to realise the meaning of light, heat and sound directly, but the electrical sense must be acquired if we wish to win the freedom of the modern world, in which electricity figures so prominently. His book is well calculated to help his readers in this respect. It begins by presenting the fundamental ideas of electricity as simply as possible and then deals with motors, dynamos and power stations. In these sections we learn not only how electricity is produced and distributed through the "Grid" scheme, but also how it is measured—a matter of importance and interest to everyone who pays electric light and power bills—and how it is used in simple domestic appliances.

The author then turns to the application of electricity to the transmission of signals and speech, with and without wires. He gives an excellent account of the working of the automatic telephone exchanges that are now being installed in various parts of the country; and the section on wireless covers a greater range than is usual, for it explains fully the production of wireless oscillations by means of Tesla coils and deals with their use in high frequency special furnaces.

The book is valuable not only because of the interesting and useful information it contains, but also because of the many neat and effective experiments described in it and the remarkably simple but sufficient manner in which every detail is explained. The general reader with practically no previous knowledge of electricity will have no difficulty in grasping the meaning of every experiment, and electrical principles are brought so clearly into relation to his daily experience that he will find it difficult to forget them. The book contains 138 illustrations, including explanatory diagrams in the text and a large number of plates reproducing photographs of electrical plant and instruments of all kinds.

This is a book that will appeal to every *"M.M."* reader who is at all interested in electricity. It is attractively written, and is full of information that is both accurate and attractive.



**Sparks from the terminal of a van de Graaff machine to which an electrostatic charge of 10 million volts is given. From "Electricity," reviewed on this page.**

### "The Locomotive Stock of the Main Line Companies of Great Britain"

This is a useful publication for railway-minded readers, particularly for those who like to keep records of locomotive numbers and of the different locomotive classes. The information given is correct up to 31st December of last year, and commences with a tabled analysis of the different locomotive wheel arrangements and the numbers of each type in use on the L.M.S.R., L.N.E.R., G.W.R. and S.R. A short review of British locomotive practice in 1935 is given, and then follow details of the types, classes and numbers of British locomotives. Not only are the four groups dealt with, but details of the locomotives of the M. and G.N. Joint line, the L.P.T.B., and the steam rail cars of the C.L.C. also are included.

Although locomotive names are not included, the names of the rail motor vehicles on the L.N.E.R. are shown. Special reference is made to the classes of locomotive that became extinct during 1935, and there is a total of 27 illustrations of typical members of these.

Copies of this useful and interesting publication can be obtained from Mr. D. R. Pollock, Publications Editor of the Railway Correspondence and Travel Society, at 102, Disraeli Road, Putney, London, S.W.15. The price is 1/2 post free.

### "R.M.S. *Queen Mary*"

(B. T. Batsford Ltd. 2/6 net)

Few events in recent years have given rise to so much excitement as the completion of the *"Queen Mary,"* the world's most wonderful liner, and her departure on her maiden voyage. The present volume is a remarkable memento of the appearance of this "Queen of the Seas," for in 84 magnificent pictures it traces her production from the time when she was merely a growing mass of steel plating and girders to the day when she was launched and named, and her memorable passage down the Clyde to meet the open sea for the first time. Impressive photographs of the wonderful halls, state rooms, swimming pools and other luxurious accommodation provided in her also are reproduced. Each illustration is adequately described, and an introduction by Mr. George Blake gives in brief the whole story of the building of this masterpiece of British shipbuilding.

### "The Young Engineer"

By J. N. Digues La Touche
(The Technical Press Ltd. 5/-)

The author has had a wide and valuable experience of engineering in India, chiefly in connection with railway construction and maintenance, and here places the benefit of the practical knowledge he has gained there at the disposal of engineering students. The result is an unusual book that does not deal with the mathematical side of engineering, but only with actual practice and the daily life of the engineer at work, supervising contractors and handling large bodies of workers. No claim is made to literary excellence. In many places the writing indeed is somewhat awkward, with unnecessary repetitions; but the author provides a wealth of information and practical wisdom.

### "Cradle of the Storms"

By B. R. Hubbard, S.J. (Harrap. 8/6 net)

The south-western tip of Alaska is one of the most interesting places in the world. There not only do the warm waters of the Pacific meet the icy Bering Sea, and thus give rise to violent storms, but the land surface itself is still in process of formation. The entire region is volcanic, and islands may yet disappear overnight, or emerge from the waters, in catastrophic eruptions and upheavals.

The district is the favourite exploring ground of Father Hubbard, famous throughout America as "The Glacier Priest," and in his lively and entertaining book he describes his latest expedition to this ever-changing corner of the world. He tells his readers thrilling stories of climbing great volcanic mountains, flying over active craters and even landing in them, and scaling precipitous pinnacles. At one point of his wanderings he was faced twice with the necessity of crossing a vast area swept by storms of such violence that not only was every stream swollen to almost incredible dimensions, but the land itself was turned into moving mud. He encounters giant brown bears, sees the birth of immense icebergs, is threatened with disaster by fierce blizzards, and finally camps in one of the greatest wonders of Alaska, the Valley of Ten Thousand Smokes. The Valley came into existence during a violent eruption, and then was covered with clouds of sulphurous steam rising skyward from cracks and craters in the ground. Now there are few of these "smokes" to be seen, but it is still a land of geysers and coloured pools that rival any to be seen in the famous Yellowstone Park in the United States.

The wonders of this amazing region and the struggles and hardships endured by the explorers traversing it are well described by the author. His book will not only satisfy the needs of readers who are in search of tales of adventure, but also will give them attractive and accurate pictures of the most amazing volcanic region in the world. It is exceptionally well illustrated by nearly 100 original photographs of intense interest.

### "Foundations for the Study of Engineering"

By G. E. Hall, B.Sc.
(The Technical Press Ltd. 7/6 net)

An engineer can only be completely successful if he is able to combine theory with practice and to reason on scientific lines in dealing with the problems that confront him. He should therefore be given a thorough grounding in the principles involved, and to provide the young engineer with what he requires in this direction is the purpose of the book.

The contents range from the laws of motion, friction, simple machines and mechanisms to the steam boiler, the steam engine and the internal combustion engine. The treatment is thoroughly practical and is illustrated by a large number of carefully planned diagrams and photographs of machines and engines. The book should be particularly valuable to students preparing for preliminary examinations.

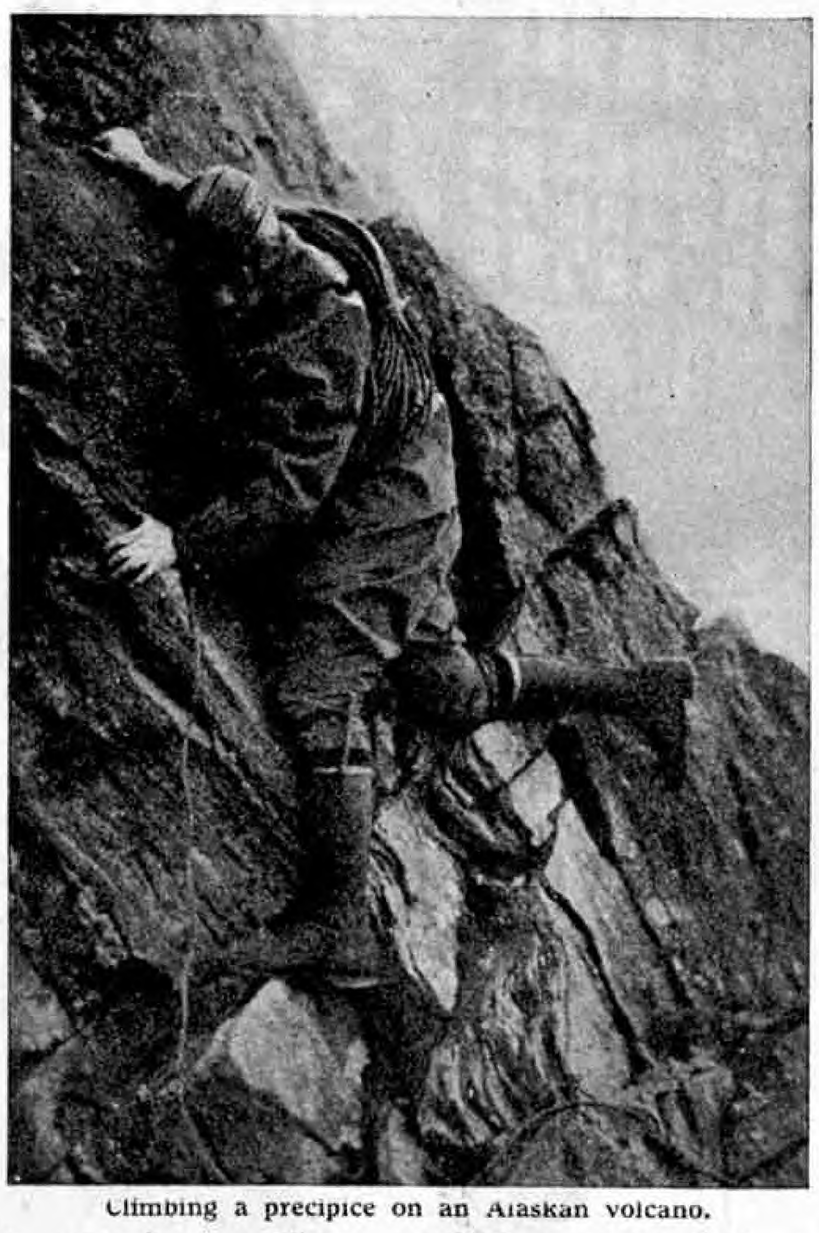
### "South with Scott"

By Vice-Adm. E. R. G. R. Evans. (Collins. 2/6)

The story of Scott's last journey across the dreary wastes of the Antarctic continent and the Great Ice Barrier is one of the epics of exploration, and the determination and heroism displayed by that great leader and the four men who died with him will never be forgotten. The tale has been told on many occasions, but never so well as by Vice-Admiral Evans, who was second in command of the Scott expedition, and himself underwent terrible hardships when making his way back with a supporting party that had accompanied Scott to a point only 150 miles from the Pole itself. For this reason the re-issue of his splendid book *"South with Scott"* in the cheaper form now reviewed is to be welcomed.



The boiling lake in Akutan Crater, Alaska. The illustrations on this page are from "Cradle of the Storms," reviewed on this page.



Climbing a precipice on an Alaskan volcano.

The book gives a complete account of Scott's great expedition from the time when it left British shores in 1910 to the return, nearly three years later, of the last of those taking part in it. Although Scott's famous march to the Pole is an outstanding feature, it is by no means the only thrill in the book, for practically every one of Scott's little band of adventurers did sterling work and endured great hardships, whether they were sailors engaged in the work of exploration or scientists probing into the mysteries of the frozen South. The members of one party were compelled to spend an Antarctic winter of intense cold and appalling blizzards in a cave hacked out of an ice drift. One factor in keeping them alive in such terrible conditions was the immense cheerfulness and the fine spirit of comradeship that they displayed. This indeed was characteristic of every man in the Expedition, as almost every page in the book reveals. The story in fact is a magnificent record of great achievement, self-sacrifice, and heroism that should be read by every boy.

### "How the Locomotive Works and Why"

By M. P. Sells, O.B.E.
(Locomotive Publishing Co. 3/6 net)

This book was originally written for the benefit of the locomotive staff of the Nigerian Government Railway, on which the author holds the position of Chief Mechanical Engineer. It has now been revised in order to render it generally useful to workers on other railways, and can be recommended to all who are interested in any way in its subject.

The contents cover every phase of locomotive working, from the combustion of coal and the duties of firemen to the distribution of steam and the function of the valve gear. Automatic brakes of the vacuum and Westinghouse types are described in detail. Lubrication is fully dealt with, and a particularly useful chapter describes systematic methods of locomotive examination.

The frontispiece of the book illustrates a three-cylinder 4–8–2 locomotive designed by the author, and there are two coloured diagrams in addition to many useful and interesting line drawings.

### "More Potted Stories"

By Vera C. Barclay
(Brown, Son and Ferguson. 2/6 net)

Miss Barclay thoroughly understands the Scout mind and has written many books that are a source of inspiration to Scouters and Cub masters. Her most recent production is a further collection of stories that are suitable for telling to Scouts and Cubs on various occasions.

Only the gist of most of the stories is given, the idea being to leave the narrator to expand them and to add dramatic effects where desirable. In addition to these "potted" stories, there are longer ones that may be read aloud in full, or treated in the manner described. Most of the stories are true and all tell of inspiring deeds of courage or comradeship, while a particularly valuable feature is the inclusion of yarns dealing with patrol animals.

# The most attractive minia and furniture ever pr

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*The Couch Hammock, Tennis Net, Garden Seats, Dinky Toys Garage, Motor Cars and Figures, and the Hornby Trees and Hedging featured in the illustration below are not included with the Doll's House and Garden.*

## DIMENSIONS

The following are the overall dimensions of the "Dolly Varden" Doll's House when built up ready for play.

| | | |
|---|---|---|
| Length | ... ... | 1 ft. 6¾ in. |
| Depth | ... ... | 10¼ in. |
| Height | ... ... | 1 ft. 6¾ in. |

The open container on which the house stands measures 3 ft. 3½ in. by 2 ft. 5½ in.

When the house is dismantled and packed in container, the overall dimensions of the complete parcel are ¾ in. x 1 ft. 7½ in. x 2 ft. 5½ in.

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The "Dolly Varden" Doll's House illustrated below has specially designed for use with Dinky Toys Doll's House iture.

The house is collapsible and the exterior is designed to es nt a half-timbered dwelling, while the interior decora-, which are printed in nine colours, are in an attractive er style.

Reinforced leather board is the material of which the house is ucted, and when set up it is as strong as a wood structure. container, which also is made of reinforced leather board, s out to show a lovely garden with Tennis Lawn, Carriage e, and Rockery, providing an exquisite setting for play with y Toys and Hornby Trees, Hedging, etc.

The Doll's House will be ready in mid-July. Price 9/6

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Supplied in two colour schemes—mauve and gold; light green and dark green.



### KITCHEN FURNITURE
### Dinky Toys No. 103

Price of complete set 2/6

| | | |
|---|---|---|
| No. 103a. | Refrigerator (Opening door) ... ... | 8d. each |
| No. 103b. | Kitchen Cabinet (Opening doors and drawer) | 10d. ,, |
| No. 103c. | Electric Cooker (Opening door) ... ... ... | 6d. ,, |
| No. 103d. | Table ... ... ... | 4d. ,, |
| No. 103e. | Chair ... ... ... | 2d. ,, |

Supplied in two colour schemes—light blue and white; light green and cream.

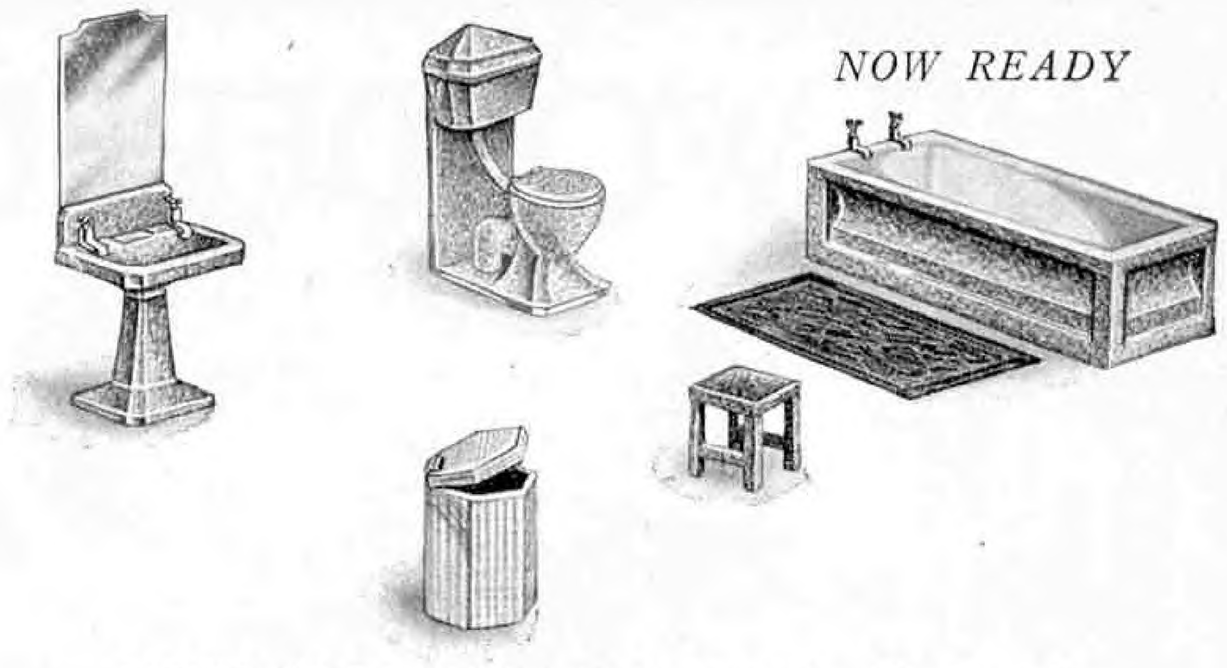
### BATHROOM FURNITURE. Dinky Toys No. 104

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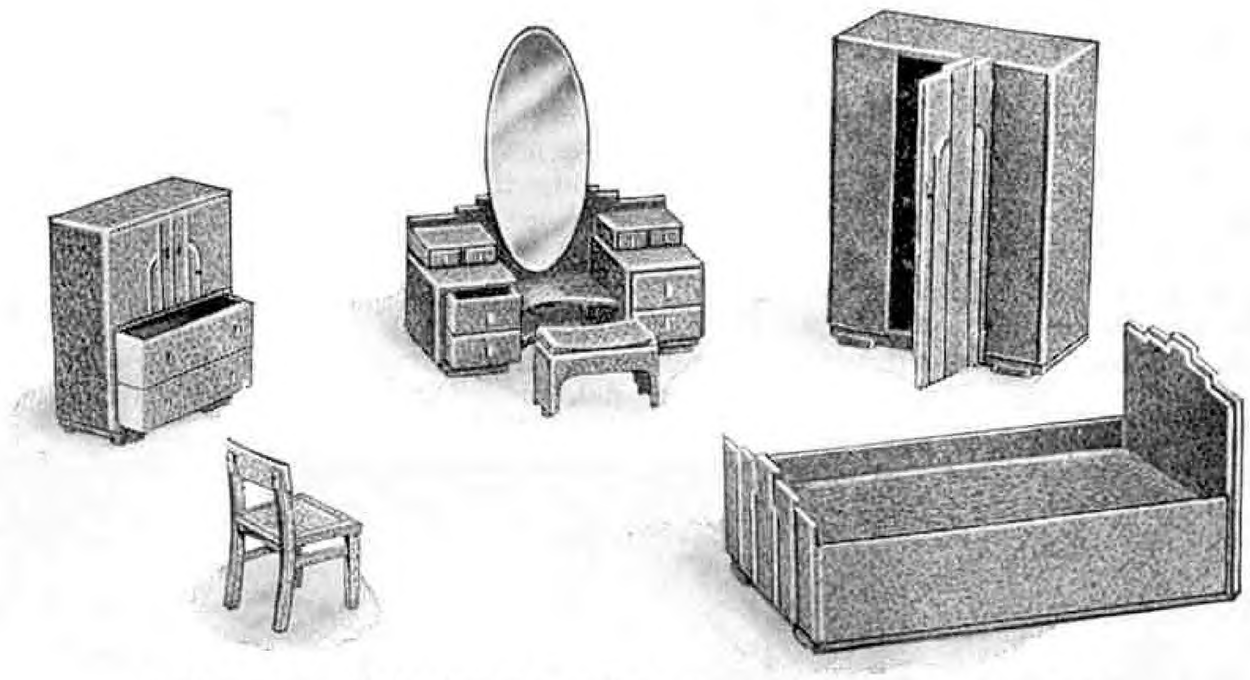
| | | |
|---|---|---|
| No. 104a. | Bath... ... ... ... ... ... ... | 6d. each |
| No. 104b. | Bath Mat ... ... ... ... ... ... | 1d. ,, |
| No. 104c. | Pedestal Hand Basin ... ... ... ... | 6d. ,, |
| No. 104d. | Stool ... ... ... ... ... ... | 2d. ,, |
| No. 104e. | Linen Basket (Opening lid) ... ... ... | 4d. ,, |
| No. 104f. | Toilet (Lifting lid)... ... ... ... ... | 6d. ,, |

Supplied in two colour schemes—pink and white; light green and white.

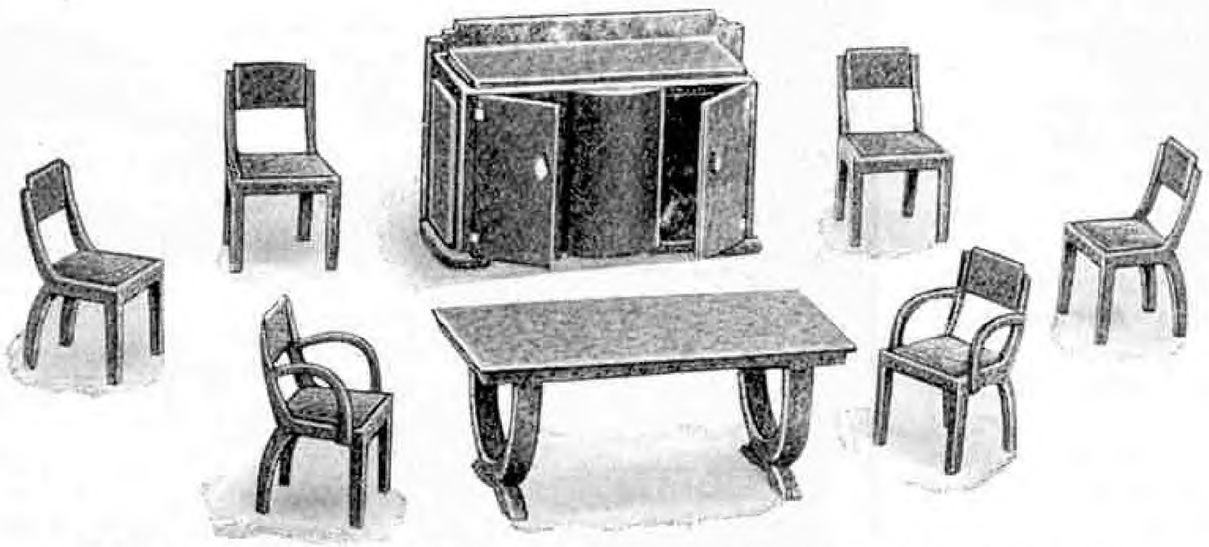
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### Salmon in Prehistoric Rivers

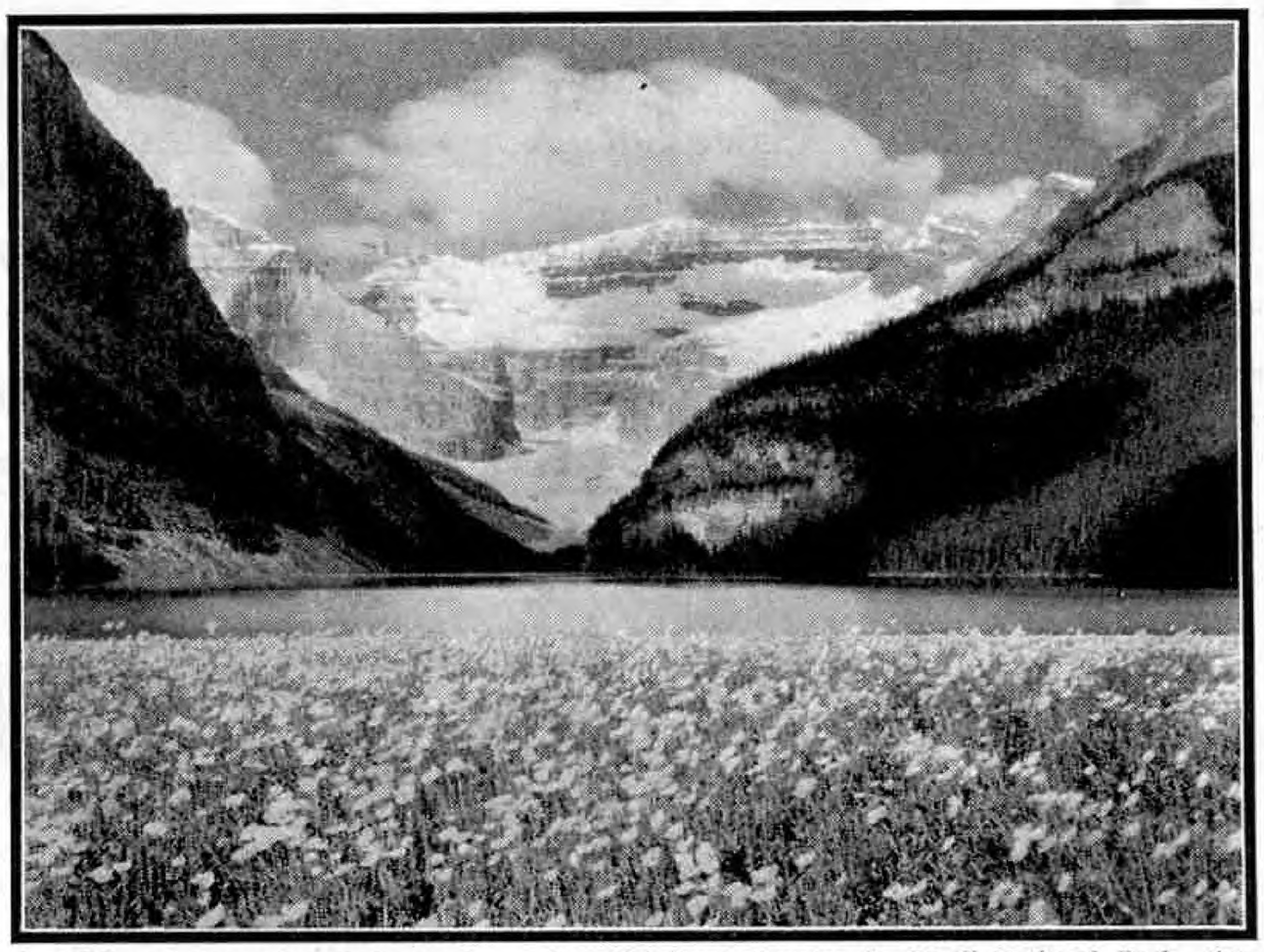
It has long been well known that the salmon alternates between fresh water and salt water, returning after its stay in the sea to spawning grounds in the upper reaches of the river in which it was born. Salmon that have been marked on their way to the sea have frequently been recaptured on entering the river down which they passed, both on the European shores of the Atlantic and on the Pacific coast of North America. This has been regarded as an instance of the cleverness or instinct that is so common in the animal world, but it has now been suggested that the fish is not really impelled by a knowledge of its original home and a desire to return to it. Its behaviour is even more remarkable than that, however, for it appears to be living in the world of the past, and to act as if unaware of the immense changes that have taken place in the configuration of land and sea during past ages.

The explanation that is now offered for the return of the salmon to the river that was its original home is simply that it never leaves it. In prehistoric times immense areas that are now under water were part of the Earth's land surface, and many of the rivers that we now know were very much longer. For instance, some of the salmon rivers of the east coast of Scotland made their way across a great plain, now sunk beneath the North Sea, to join a mighty stream formed by the union of the Rhine and the Thames that flowed northward to a sea coast that stretched roughly from the north of Scotland to Norway. The channels of these ancient rivers still exist under the sea, and it is believed that the fish follow them, just as their ancestors did in prehistoric ages when fresh water flowed along them.

This idea is strongly supported by the fact that salmon have never been found at sea outside the limits of what is known as the continental shelf. This is a comparatively shallow area extending from the continents to a kind of underwater coast or cliff beyond which are the deep waters of the ocean itself. The salmon appear to collect at the prehistoric estuaries of the rivers in which they were born, and between October and March they return along the underwater channel and up the present-day rivers to reach their spawning grounds.

### Photographing a Swordfish Attack

Turning from the salmon to a deep water fish of a far more ferocious disposition, I have been interested to find that the attack of one of these creatures has at last been photographed. Stories of swordfish driving their extraordinary weapons through the planking of boats are by no means uncommon, but this record actually showing the fish with its sword partly outside and partly inside a boat is unique. The fish was harpooned from a yacht and a man was sent out in a dory to bring it alongside. He experienced so much opposition that the master of the yacht anticipated trouble and got ready to take a photograph of anything of interest that might occur. He suddenly saw the flash of the fish in the water charging the dory and released the shutter, fortunately catching the fish exactly at the right moment. The attack that was photographed was not the only one made by the swordfish, for immediately afterwards it made a second lunge that ripped one plank entirely out of the boat and caused it to sink. When the fish was hauled on board it was found to weigh 350 lb.



A striking photograph of Lake Louise, a beautiful sheet of water in Banff National Park, the famous reservation among the peaks of the Canadian Rockies.

### A Ravenous Insect

Most readers of the *"M.M."* will be familiar with pictures of the mantis, the insect that folds its forelegs in an attitude of prayer, and those who live in warmer climates than that of Great Britain may be familiar with the creatures themselves. In spite of the peaceful appearance this remarkable attitude gives it, the mantis is extremely bloodthirsty and has an enormous appetite for all kinds of insects. It lies in wait for its victims on a tree or shrub, with its head bent downward and inward and its long forelegs held before it. The instant a fly or other insect comes near its legs shoot out like lightning. Sharp spines on their inner sides fold round the victim, which is then immediately devoured.

The praying mantis has found its way to the United States. There it was accidentally introduced 30 or 40 years ago, and in many parts of the country has flourished to such an extent that it is now a common object in early autumn. Fortunately no ill effects are likely to follow its arrival there, for unlike many insects that have travelled from one part of the world to another, it is not a nuisance and does not damage crops. On the contrary, it is beneficial, for it devours insects that are destructive to vegetation.

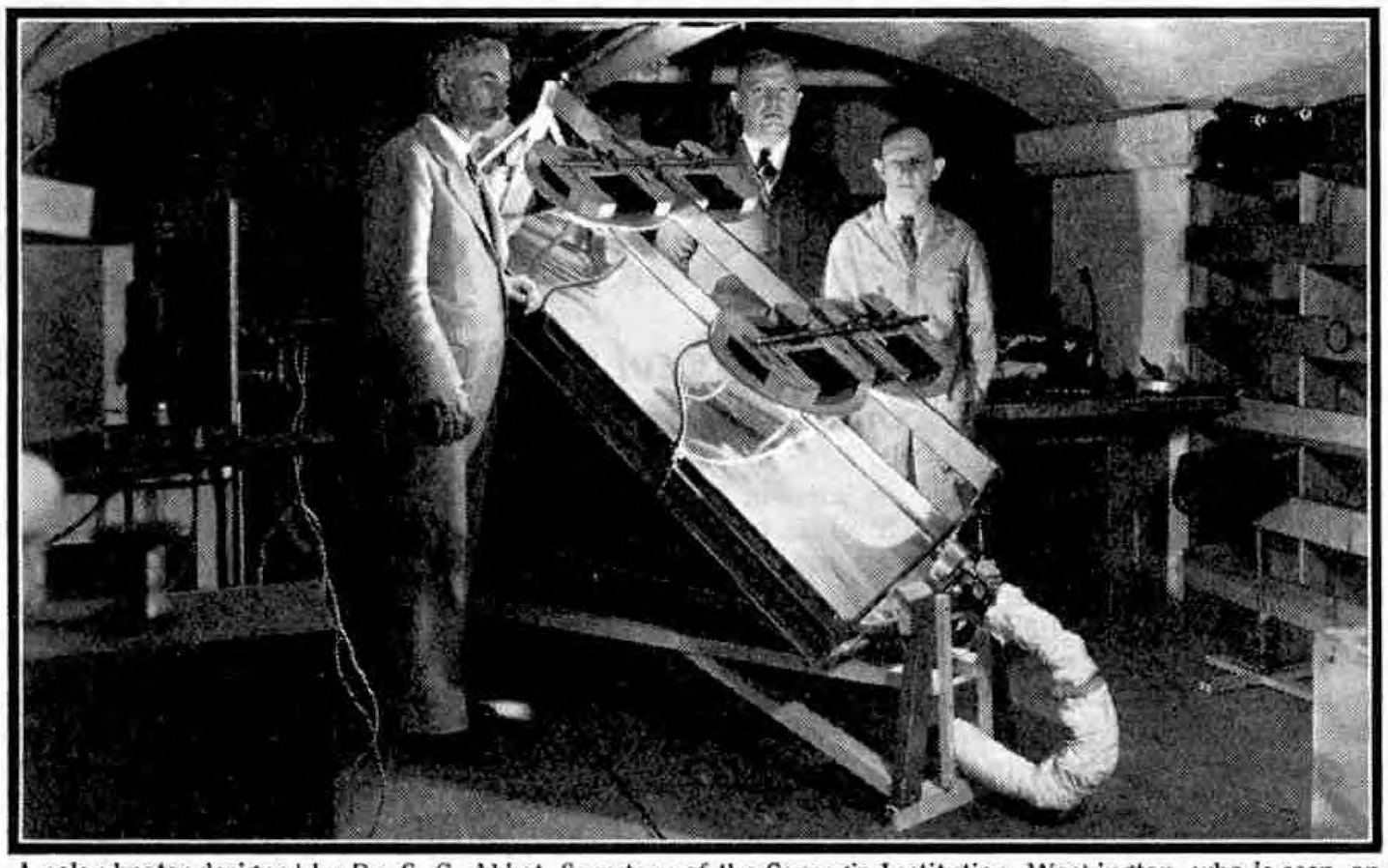
The mantis is about 4 in. in length, and when its wings are spread to the full they have a span of 6 in. It is capable of strong flight and has even been found on the highest windows of skyscrapers in New York.

### Putting the Sun to Work

Indirectly all our usual sources of power can be traced back to the Sun. Coal has been described as "bottled sunshine," for it consists of the carbonised remains of plants of millions of years ago. Oil also represents the solar energy of past ages,

and even the wind and waterfalls owe their origin to the Sun, for both movements in the atmosphere and the fall of rain are due to its activities.

While we are steadily using up our sources of power, we are allowing the rays of the Sun, their creator, to stream unharnessed into space. Some day we may find that we shall have to make use of these rays, and no doubt efficient schemes will have been devised when that time comes. Many efforts have already been made to use Sun power directly. The principle in most of these had been to concentrate the Sun's rays by means of curved mirrors on to boilers of various shapes in which liquids are heated. In an extensive plant of this kind erected in Egypt many years ago, the boilers were long thin tubes placed within channel-shaped reflectors that were tilted by automatic gearing to enable them to follow the Sun and make full use of its rays throughout the day. The plant was more costly to erect and run than a boiler fired by coal, but it was a very promising attempt, the best output being one brake horse power for every 183 sq. ft. of surface.



A solar heater designed by Dr. C. G. Abbot, Secretary of the Carnegie Institution, Washington, who is seen on the left. The four overhead mirrors and the lamps under them form an artificial Sun for demonstration purposes. Photograph by courtesy of Dr. Abbot.

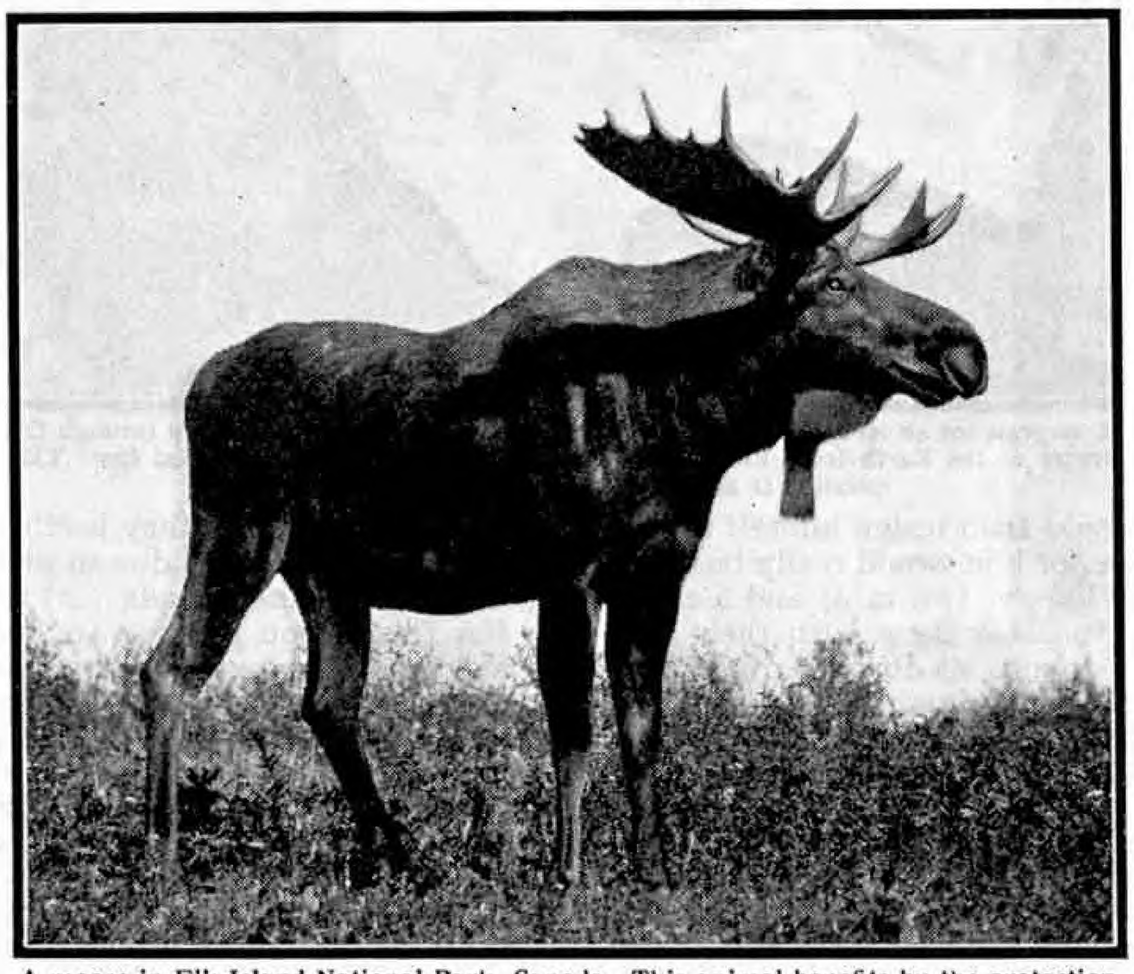
### A New Solar Engine

By far the most successful results yet achieved in this direction have been obtained with the aid of the simple solar heater illustrated on this page. This was devised by C. G. Abbot, Secretary of the Smithsonian Institution, Washington, who has been making experiments in the use of the Sun's rays for cooking and other purposes for 20 years. His reflector is a sheet of "Alcoa," a very light alloy made by the Aluminium Company of America. This reflects more than 80 per cent. of the Sun's rays, and exposure to the weather for a year has no appreciable effect on its surface. It is bent into the form of a parabola by screwing it down on a special frame, and it brings the Sun's rays to a focus along a line no wider than a lead pencil.

The greatest novelty in Dr. Abbot's apparatus is the form of heater he employs. This consists of three concentric tubes of pyrex glass fitted along the focal line of the mirror. The central tube is only $\frac{1}{2}$ in. in width, and inside it is a black liquid called "Aroclor," a complex organic substance, in which a little lampblack is placed. When treated in this manner the liquid almost totally absorbs the rays focussed upon it. A vacuum is maintained in the spaces between the tubes, thus forming a kind of thermos flask in which little of the heat absorbed is wasted.

When the Sun's rays are directed on to the mirror and focussed on to the heater, the "Aroclor" becomes hot and circulates through the tube naturally, as in a domestic hot water system, passing away to the place where its heat can usefully be absorbed for cooking or for producing steam. When it has cooled it re-enters the central tube at the lower end. The heater shown in our illustration makes use of powerful electric lamps as a substitute for the Sun, as it is being used for indoor demonstrations. The rays of these lamps are concentrated by means of four overhead mirrors.

This little apparatus is three times as effective as the plant tried in Egypt. A $\frac{1}{2}$ h.p. steam raising model is now being constructed, and it is believed that the success that has so far attended Dr. Abbot's experiments has brought us near the stage when the direct rays of the Sun will become a serious competitor with coal and oil. The Sun does not shine continuously, and some means of storing the energy it gives us therefore will be necessary. This can readily be arranged either by using its power to charge giant accumulators, to pump water to a reservoir on a convenient hill or mountain, or simply by some form of heat storage. Chemical methods of storing it also have been suggested.



A moose in Elk Island National Park, Canada. This animal benefits by the protection afforded it in the National Parks of Canada, where it lives a peaceful, un-hunted life.

### The Monarch of the Deer Tribe

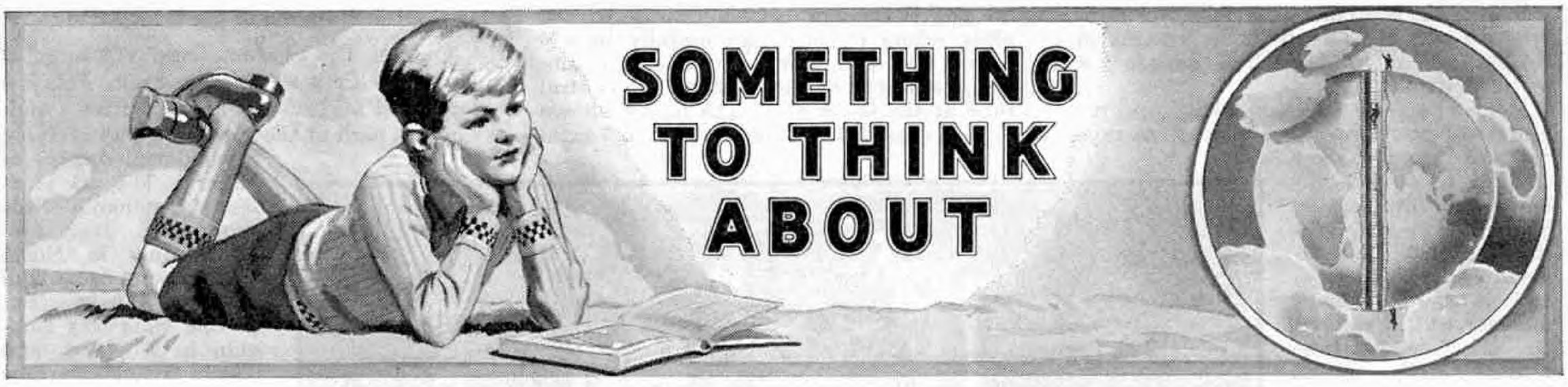
One of the characteristic creatures of Canadian life is the moose or elk. This is a large and magnificent animal, often standing 7 ft. high at the shoulders, and carrying a wonderful display of antlers. The elk is in fact the monarch of the deer tribe. It is now found only in North America and in parts of Northern Europe, but at one time was common in England, and also in Ireland, the now extinct Irish elk being even larger than the Canadian animal.

The elk is a powerful swimmer, and in summertime revels in deep swamps, where he tears up aquatic plants and frees his mouth and nose of mud and water by loud blowing that betrays his presence to the hunter. Like most game animals he is now protected, and many of the old tricks by which he was once tracked down and slaughtered are no longer allowed. For instance, it is forbidden to go out at night by boat with a flare to a place where an elk has betrayed his presence by blowing, in order to shoot him while he gazed at the flare in stupid wonder. The use of dogs also is not allowed, and the animal cannot be hunted by men on snowshoes when a thaw has been followed by a frost and the surface carries the weight of the hunter, but breaks under the hoofs of the elk and hampers his flight.

One curious trick the elk shares with the African buffalo. He has a very keen sense of hearing, and when he wishes to rest he turns to windward from his track so that he is in a position to scent pursuers following him. It is this trick that makes the African buffalo so dangerous, especially when wounded, for the hunter often then has been transformed into the hunted, and the elk makes use of it for his protection.

### A Bean with 300 Uses

For centuries Man has been content to make use of trees and vegetable products for one or two obvious purposes only, but every year their value is being greatly increased as new applications are found for them. Wood of course is an excellent example of this. It no longer provides material only for the fire or for the carpenter, but is the raw material for paper and even for dress materials, as from it rayon or artificial silk is now made on an immense scale. Cotton also does more than provide a valuable fabric, for it enters into the composition of an almost endless list of articles from finger nail polish to high explosives. Another subject of surprising developments of this kind is the soya bean, long regarded only as a suitable food for pigs, but now providing also a plastic material and an oil that is largely used. Altogether more than 300 possible uses have been discovered for it.




## *I. If a shaft were dug through the centre of the Earth from England to Australia, would anyone descending into it come out on the opposite side feet first or head first?*

THIS may seem a frivolous question, but finding an answer involves so many interesting problems that it is worth while to stop to consider it. In order to arrive at a solution it is necessary first to appreciate the startling fact that in space there is no absolute right way up. We feel that we are right when our feet are on the ground, and our heads are pointing to the sky, and soon become uncomfortable if we reverse the position and stand on our heads. It is easy to imagine conditions in which what we should regard as an upside-down position would be the only reasonable one, however. Suppose that a man enters a room in which gravity pulls objects towards the ceiling instead of the floor, or in which some artificially-created force of the same kind directed upwards overcomes gravity. Immediately a man entered such a room he would rise until his head came into contact with the ceiling. This probably would be painful, for the movement would be involuntary and could fairly be described as a fall. It would in fact be the same kind of movement that would happen if a man were to enter an ordinary room by the ceiling instead of through a door on the floor level.

When the victim of this trick recovered and stood up, he would automatically place his feet on the ceiling with his head hanging downward towards the floor. If he became alarmed by this unusual position, and by vigorous struggles succeeded in attaining what he had previously thought to be the correct attitude, with his feet downward, he would experience the same uncomfortable sensations as we undergo when we stand on our heads. Profiting by experience, he would then resign himself to the upside-down position, which of course for him would really be right side up. He would then be perfectly happy. If a table and a chair were brought in, he would be able to place them with their feet resting on the ceiling, and would be able to sit down, write at the table, and in fact behave exactly as we do in the more ordinary rooms of the buildings in which we live. He would not feel that anything was wrong and in truth he would be right way up in his own little world.

This will make clear how it is that people in both England and Australia remain on the surface of the Earth and act in a perfectly normal manner, although they are on opposite sides of the great ball on which we live. Each of course thinks that he is right way up and the other is upside-down, and both are right. Strange as it may seem to us now, this was difficult to understand not very long ago, when the Earth was believed to be more or less flat. The suggestion that our planet is really round was then violently ridiculed on the ground that people on the opposite side of it would fall off! That anyone could live in what was then thought to be an upside-down position was regarded as utterly fantastic.

Now let us return to our large scale excavation and see what would happen if we dug a hole through to Australia. As the shaft grew deeper the temperature in it would rise, and long before the diggers reached the centre of the Earth they would be burned to cinders, or even converted into gases, chiefly carbon dioxide, and blown back up the shaft. Molten rock under high pressure also would be encountered deep down in the Earth, and dealing with this would be about as easy as trying to hold back the boiling lava that is thrown out with terrific force by a volcano.

Let us suppose that means of overcoming these and other difficulties are found, however, and that the shaft has been driven to the centre of the Earth. Up to that point the hardy adventurers making the trip would have been moving in the direction in which the force of gravity is exerted. As soon as they tried to go farther, however, they would be opposed by gravity, and would be compelled to cling to something if they wished to remain on the "floor" of their shaft. If they let go their hold they would drop back towards the centre, past which they would be carried by the impetus due to the fall. The direction of the force attracting them would again change as they passed the centre. They would therefore once more be pulled back and again would overshoot the mark, but this time in the opposite direction and by a smaller distance. They would continue to oscillate to and fro in this manner for a while before coming to rest.

Once they had settled at the centre of the Earth, in whatever direction they moved they would immediately be dragged back again by the force of gravity. For them there would be no "down," as any direction would be "up," and in this respect they would be in a somewhat similar position to that of a man standing at the North Pole, who would go south whether he stepped forward, backward or sideways.

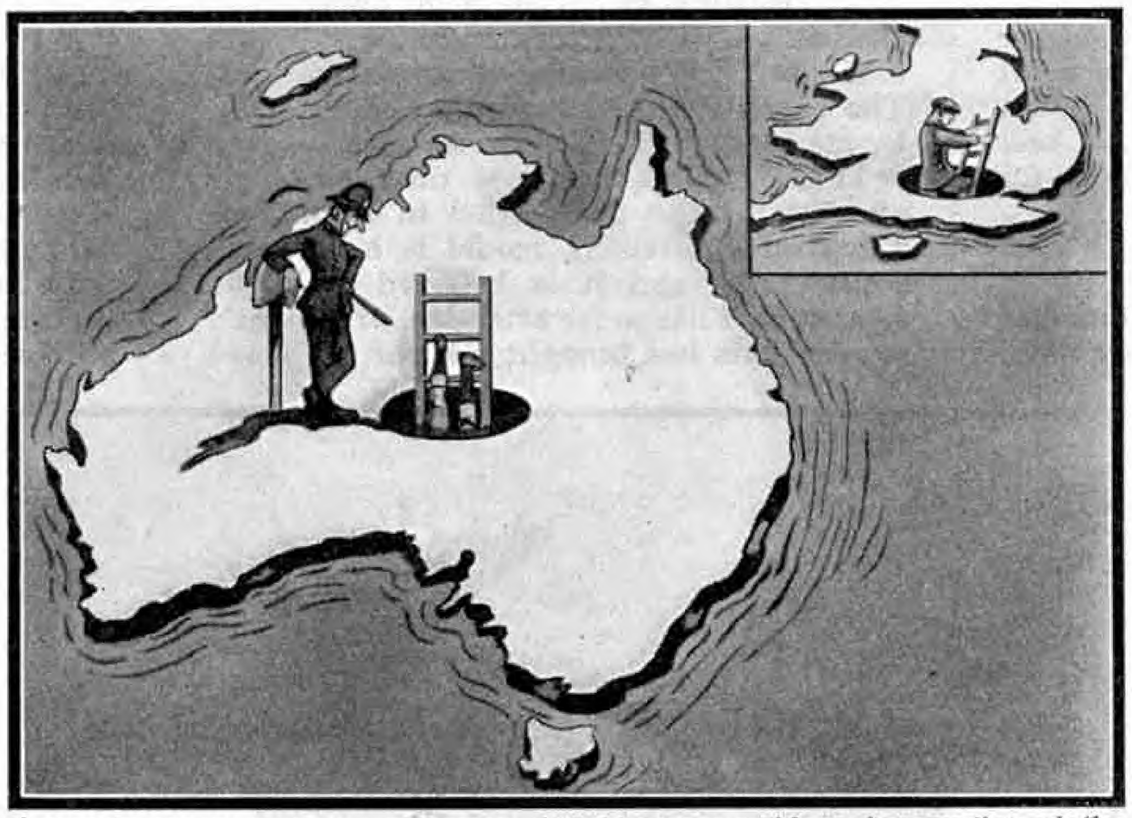
If they had been sensible enough to fit the shaft with side ladders to enable them to cling to their working face, they would still be very uncomfortable, for the direction of the pull due to gravity on their bodies would be from their feet to their heads, and in effect they would be upside-down. For this reason progress with their work would be difficult. They also would be hampered by the necessity for attaching themselves to the ladder, and would be surprised to find that considerable effort would be required to push their picks and shovels, or whatever tools they were using, towards their feet.

If they could maintain this position while they are digging out the remaining 4,000 miles of their gigantic bore, however, they would astonish the policeman seen in our illustration by breaking ground in Australia feet first, and he would have every excuse for arresting them as dangerous lunatics threatening to turn everything in Australia topsy turvy. This of course is impossible and they would be compelled to reverse their positions, directing their heads towards Australia and their feet towards the centre of the Earth.

Even then their troubles would not be over. They would still have to lash themselves in some way to their ladder and, as their "floor" would have become a roof, they would have to "dig" above their heads. The one task that would be simplified would be the disposal of the spoil. Once they were past the halfway stage the material they broke loose with their tools would simply fall towards the centre of the Earth and there form an ever increasing plug in the long tube.

It will be realised that if our pioneers survived the hardships and terror of their immense task, they would emerge from their great bore head first.

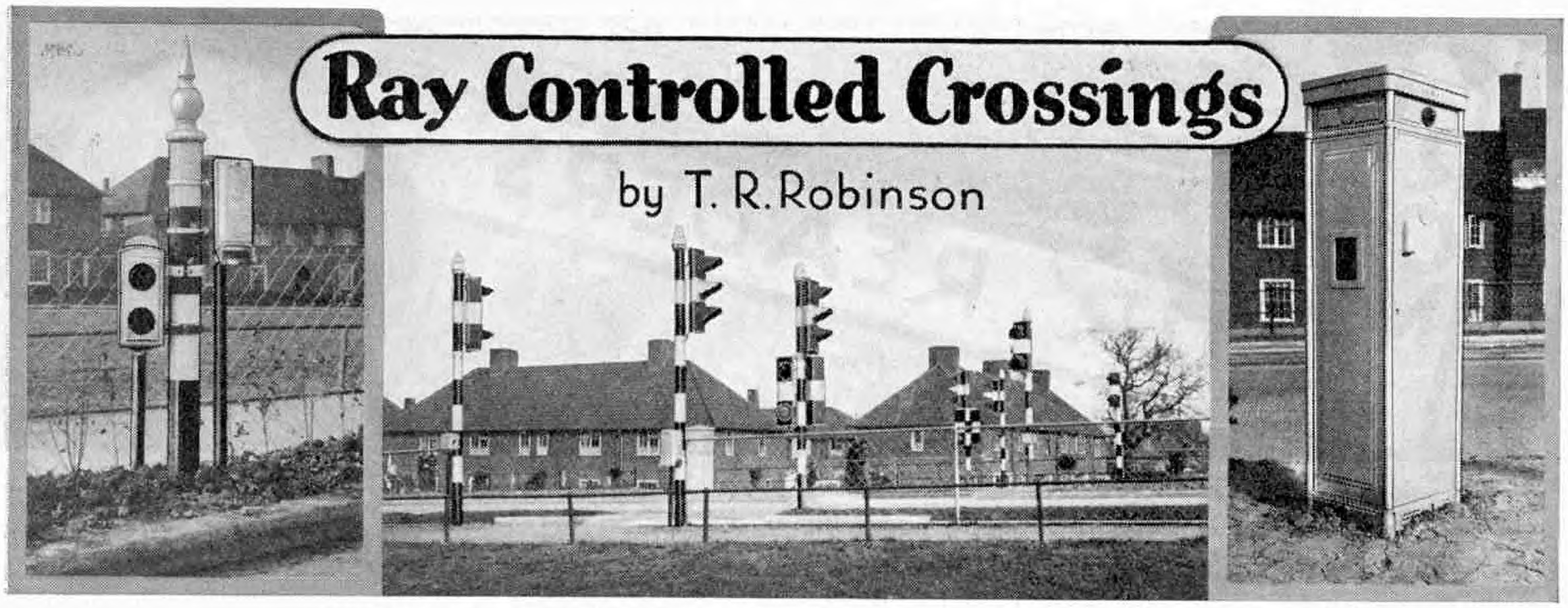
H. A. ROBINSON.



**A surprise for an Australian policeman. Would anyone making a journey through the centre of the Earth from England to Australia emerge feet first or head first? This question is answered in the accompanying article.**

# Ray Controlled Crossings

by T. R. Robinson



## TRAFFIC SIGNALS THAT DIRECT PEDESTRIANS

CROSSING a busy road is nowadays a somewhat perilous adventure, and there may be danger even in walking across a street or lane in which traffic is not very dense or frequent, for modern vehicles move swiftly. Many schemes have been suggested in efforts to diminish the risk of accident, or to abolish it altogether. Special places for crossings of course have to be provided if control is to be exercised. The ordinary controlled crossing, familiarly known as the Belisha crossing, is not entirely satisfactory, however, for it is simply a zone in which motorists and the drivers of other road vehicles must respect the rights of those on foot, and no definite signals are given.

Crossings provided with signals for both road users and foot passengers have now been introduced. In these the signals directing pedestrians are of what is called the "two-aspect" type, showing one or other of the two instructions *"Cross Now"* or *"Do Not Cross."* The usual red, amber and green signals are used for road traffic, and the two sets work in conjunction with each other. Anyone wishing to cross the road presses a special switch fitted on a post. This changes the lights against oncoming traffic to red, and causes the two-aspect signal to show *"Cross Now."*

In practice it has been found that many pedestrians fail to use the switches at crossings of this kind, and either wait for a lull in the traffic or dodge in between passing vehicles and thus run unnecessary risks. An entirely new system therefore has been devised in which pedestrians automatically and involuntarily demand the right of way. The first crossing of this new type was put into operation in St. Helier Avenue, on the Sutton by-pass road, Morden, Surrey, and is illustrated at the head of the page. The crossing chosen connects two sections of a great housing estate and passes over a busy arterial road, with up and down carriage ways and a central dividing strip, and therefore is particularly suitable for the installation, which is somewhat in the nature of an experiment.

Barriers along the sides of the road ensure that the crossing is made at a definite place and the approach to this is spanned by a ray of light that is interrupted by anyone wishing to cross. The beam normally falls upon a device, known as a photo-electric cell that is sensitive to light. When the beam is interrupted the internal electrical resistance of the cell is lowered, and it permits sufficient current to pass through it to operate a relay. This action in turn completes a circuit that operates contacts in a master controller, and thus records the demand. If no traffic is approaching the signals change at once, showing first amber and then red on the roadway and altering the other signal indication from *"Do Not Cross"* to *"Cross Now."* In other circumstances the pedestrian signals change in a very short time.

The entire crossing is controlled by means of light rays, for there also are beams across the up and down carriageways and these are arranged to detect the presence of vehicles at distances of from 85 to 110 ft. There are no unfair delays, either for traffic or for pedestrians. Unless a foot passenger actually is waiting to cross, the road lights remain at green, and are only interrupted when the pedestrian beam is broken. Even a more or less continuous succession of vehicles, each in turn operating the road signals, is interrupted automatically after a definite time when a pedestrian gives the signal that he wishes to cross, however. Similarly, when the signals have released the traffic, they cannot again be changed to favour the pedestrian until a certain time has elapsed. During the waiting period the presence of somebody on foot waiting to cross is noted and remembered, and he is allowed to proceed at the first opportunity.



**The illustration at the head of the page shows the light-ray controlled crossing at Morden, with the ray transmitter for vehicles on the left and the receptor box on the right. In our lower illustration the twin light rays in the middle of the pedestrian crossing are being interrupted.**

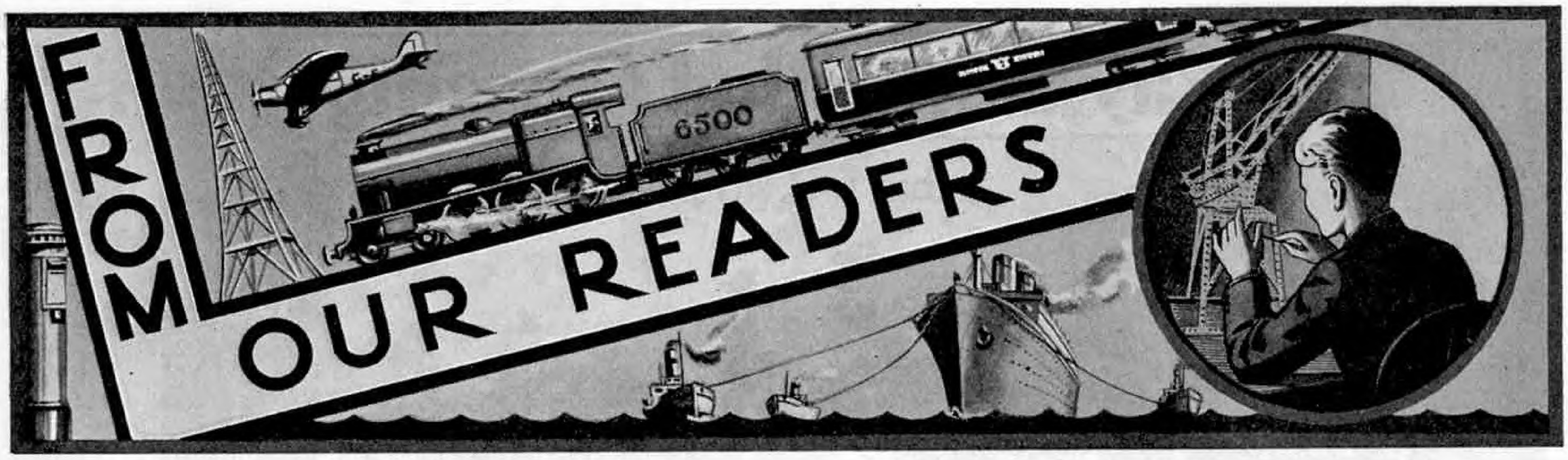
The light ray apparatus for the pedestrian crossing is seen in our illustration, which shows a double set installed on the dividing strip in the middle of the road. On one side is the box containing the ray transmitters, which are provided with small filament bulbs similar to those used for motor car headlamps. These are mounted with reflectors and lens systems that focus their beams on the windows of the receptor boxes opposite them. There they fall on the photo-electric cells, which are placed behind coloured glass screens.

The arrangement of the vehicle units is similar, but in this case lenses are fitted in the receptor box as well as the transmitter. These focus only the beams from the transmitter on the photo-electric cell, and thus interference due to the lights of passing cars is prevented. The beams actually are invisible, for the lamps are fitted with infra-red screens in order to prevent the ray transmitter lights from causing glare to approaching drivers. Two lamps are fitted to each vehicle transmitter, but only one of these normally is in service. The second comes into action automatically if the first fails for any reason, and a warning red light then appears on the side of the controller pillar.

An interesting feature is that the light beams cross the carriage ways at an angle. The result is that fast moving vehicles on the inner side of the road are detected when they are farther from the crossing than those moving more slowly, which of course usually are nearer the pavement. Thus the speedier traffic is given a greater distance in which to pull up if this course is necessary.

The pedestrian crossing units are four in number, one at each entrance to the crossing and two on a refuge in the central dividing strip. Anyone crossing the road therefore breaks four rays and the arrangement can be used to allow a pedestrian to cross one traffic lane and then to halt him at the road centre until the other lane is clear, at the same time releasing the traffic behind him.

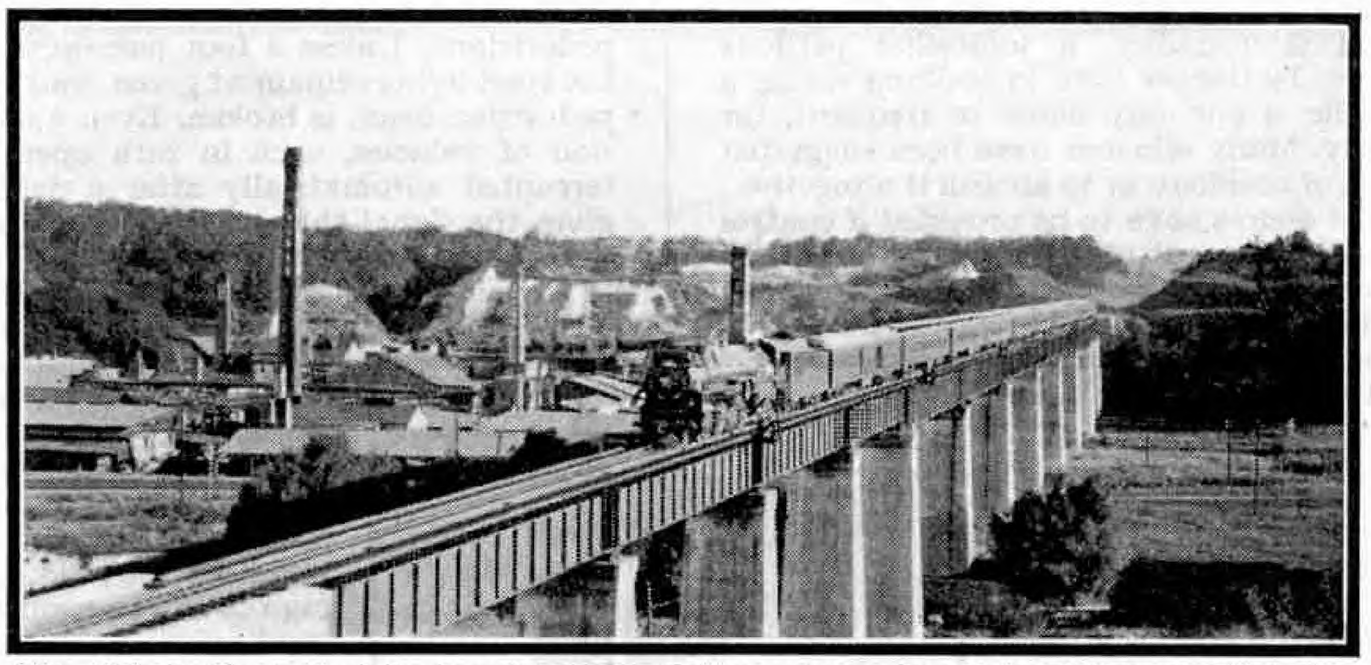
The master controller is almost human in the way in which it responds to the various demands made on it. For instance, when one pedestrian is crossing, the passage of a second through the beam automatically causes the signal *"Cross Now"* to be shown for a longer time. The direction in which a crossing is made also is detected, so that traffic is not stopped by a foot passenger leaving the crossing as well as approaching.




*These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.*

## *"The Chicago Express"* of the C.P.R.

The accompanying photograph shows Canadian Pacific Railway train No. 21, *"The Chicago Express,"* crossing the Don Valley Bridge between Leaside Station and Don Station, Toronto. This train is one of the finest on the North American continent. It leaves Montreal every night at 11.15 p.m., reaching Toronto at 7.45 a.m. next morning and arriving in Chicago, 852½ miles from Montreal, at 8.10 p.m.



"The Chicago Express" of the Canadian Pacific Railway crossing Don Valley Bridge, near Toronto. Photograph by J. Adams, Toronto.

The engine at the head of the train when the photograph was taken is No. 3100, and is one of two built especially for this run, and known as KIA class. Its wheel arrangement is 4–8–4. It was built in 1928 at the Angus Shops of the C.P.R. in Montreal and follows the standard practice of that railway in having nickel steel boilers and fittings. The steam pressure is 275 lb. per sq. in., the driving wheels are 6 ft. 3 in. in diameter, and the tractive effort is 60,800 lb. The total length of the engine is 97 ft. 5½ in., and the firebox is fitted with a mechanical stoker.

The train is always very heavy. Sometimes there are as many as 19 cars, of all-steel construction, and as each car weighs nearly 80 tons the total load behind the engine then is more than 1,500 tons. Even heavier loads are occasionally known, and I have a photograph of this train leaving Leaside with 20 cars.

The bridge over which the train is passing is 1,150 ft. long and was strengthened in 1928 to allow the passage of locomotives of the KIA class. It carries the mainline of the C.P.R. between Montreal and Toronto over the Don Valley, and its height may be gauged by contrast with the chimneys seen on the left. J. ADAMS (Toronto).

## Brittany's "Emerald Coast"

I was very glad to be able to visit Brittany on holiday last year, and in excited anticipation conjured up thoughts of rocky and irregular coasts surrounded by a beautiful emerald sea. In this I was not disappointed and cannot think of a more suitable name for this famous holiday district than the "Côte d'Emeraude," the Emerald Coast.

During my short stay I was only able to see the district round Dinard and St. Malo. The latter is an old naval fortress. Its tortuous cobbled streets are very narrow, in few places being more than 10 ft. in width, and as the speed limit in the town itself is as low as 4 m.p.h., driving a motor car within its walls is not a very agreeable pastime. St. Malo is separated from Dinard by the River Rance. There is no bridge to connect the two towns and a ferry service conveys passengers, cars, luggage and mail across the river.



Mont St. Michel, a famous islet off the coast of Normandy. Photograph by A. Frodsham, Crowborough.

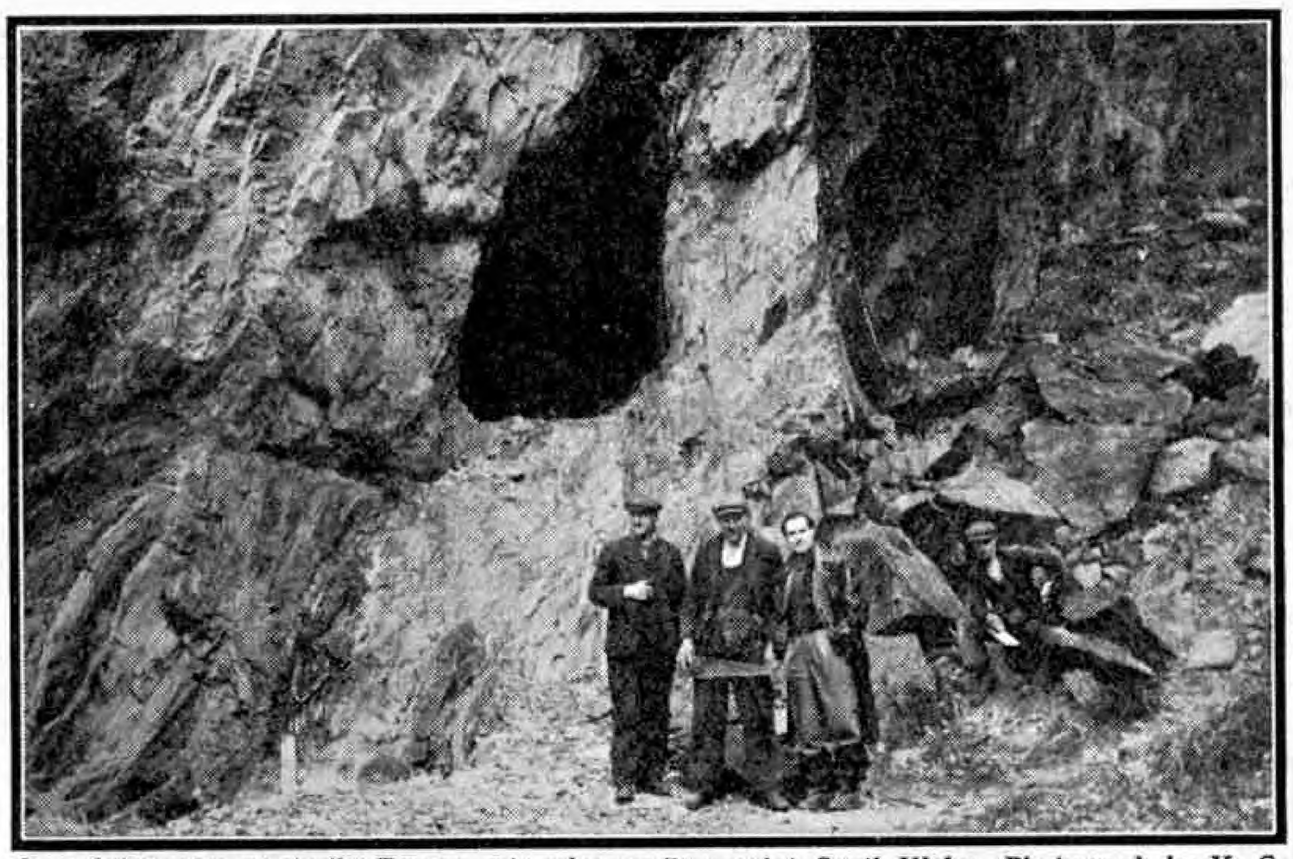
At its eastern extremity Britanny is separated from Normandy by the River Couesnon, and just within the Norman boundary stands the famous Mont St. Michel, crowned by a monastery of the 11th century. This is not really an island, as it is usually described, for it is now connected to the mainland by a long built-up road or causeway. At low tide the sea cannot be seen and indeed is believed to withdraw as much as 12½ miles from the mainland. As high tide approaches a wall of water suddenly appears on the horizon and within 20 minutes the mound is surrounded, only the causeway remaining above water.

The unique streets of the town that has grown up on the island are even narrower than those of St. Malo.

A. FRODSHAM (Crowborough).

## Gold Mining in South Wales

I recently visited the gold mine workings near Pumpsaint, Cardiganshire. These are situated in a cleft of the hills that rise from the Cothi Valley. The mines were worked at least as far back as Roman times. This accounts for the abundance of rock mosses in the neighbourhood, for these probably were cultivated by the Romans, who are believed to have used them for medicinal purposes. The old galleries are cut into the hillside in such a manner that accumulations of water could run out at the entrances, for the Romans do not appear to have used pumps. They extend over 4 miles through quartz that has been hewn by hand.



One of the entrances to the Roman gold mines at Pumpsaint, South Wales. Photograph by K. G. Bilbe, London, S.W.12.

The present workings are reached by a vertical shaft 260 ft. in depth. This pierces some of the lower levels of the Roman mines, and one cavern, known as the Cathedral, contains many rock pillars that were left to support the roof. The present company has suspended weighted lines over basins of water in this part of the mine to indicate movements in the rock strata. Examinations are made if the weights dip into the water.

The ore is grey or white in colour and contains lead, silver and mica in addition to gold. Work is carried on day and night in the light of acetylene lamps, and there are no gases to contend with, as there are in coal mines. The use of modern machinery has increased the output of the mine. This includes a huge Blackstone oil engine that drives air compressors feeding the ventilating system as well as the drills with which the ore is extracted. Another shaft has just been commenced.

I found the miners exceedingly friendly and helpful. They come from all parts of Wales and stay for weeks at a time on the premises, which include social rooms and a canteen, and they willingly showed me round their quarters.

K. G. Bilbe (London, S.W.12).

## A Perilous Climb

Recently I had the opportunity of visiting a site on which is being erected a new block of flats of modern steel frame construction. In this form of building the loads are carried down to the foundations by a framework of steel and it is fascinating to watch this grow.

Part of the steelwork of the new flats had been erected when I visited the site, and men were busy overhead fixing new parts in position, walking calmly along narrow girders and balancing themselves easily in the most precarious positions. As I watched them I thought that certain death awaited a false step. In spite of this, I made up my mind to see them at close quarters. Feeling extremely nervous, I climbed ladders, walked along girders where careful balance was needed, and clambered round stanchions until I reached a height of 50 ft. above the ground. There I kneeled down on a plank that bent alarmingly whenever I moved, and photographed the men at work.

Right over my head, and another 15 ft. higher, was the crane that hoisted the steelwork into position. The men working it invited me to go up and "take their pictures," but I made the excuse that I had run out of films, and in a very short time was again safely on solid ground. My little climb gave me a pleasant thrill, but I prefer to spend my days working a little nearer the earth.

E. H. Coles (London, W.11).



Erecting the steelwork of a giant building. Photograph by E. H. Coles, London, W.11.

## In a Devonshire Pottery

While on a recent holiday in Devon I joined in a very interesting visit to a pottery near Torquay. Our guide first showed us a machine in which the raw, red clay is mixed with water and passed through a very fine sieve that retains impurities. The liquid mixture formed is led through pipes to a machine in which the water is pressed out, leaving pure clay, or "slip," ready for use in the pottery. In appearance this reminded me of "Plasticine."

Certain articles, such as plates and ash trays, are formed in moulds of plaster of paris, which automatically absorbs surplus moisture from the clay. Vases and bowls must be shaped, and in the potter's room we watched the making of a vase. The potter or "thrower," as he is called, placed a lump of clay on his revolving wheel, and shaped it with his hands, being guided as to height and width by gauges projecting over the wheel. When the vase was satisfactory, he cut it from the wheel with a wire.

The next step is to smooth the surface and edges of the vase on a lathe, and we saw this process in operation with vases that had been dried. These were then dipped in a tank containing a coloured liquid, and designs were painted on them when they had dried. They were then ready for baking.

P. Hawks (Shortlands).

# Electric Winders for Gold Mines

## Raising Ore from a Depth of 6,600 ft.

THE general appearance of pithead hoisting gear is familiar to all who live within reach of a colliery district, or have visited or passed through one. It consists of two immense narrow wheels, set side by side at the top of the pithead buildings. Cables from the winding machinery pass over these and disappear vertically into the shaft up which coal is hoisted and men are lowered to their work and raised to the surface. When the gear is in operation the wheels revolve at high speed in opposite directions, for each of the two ropes supports a cage, and one cage is raised as the other is lowered.

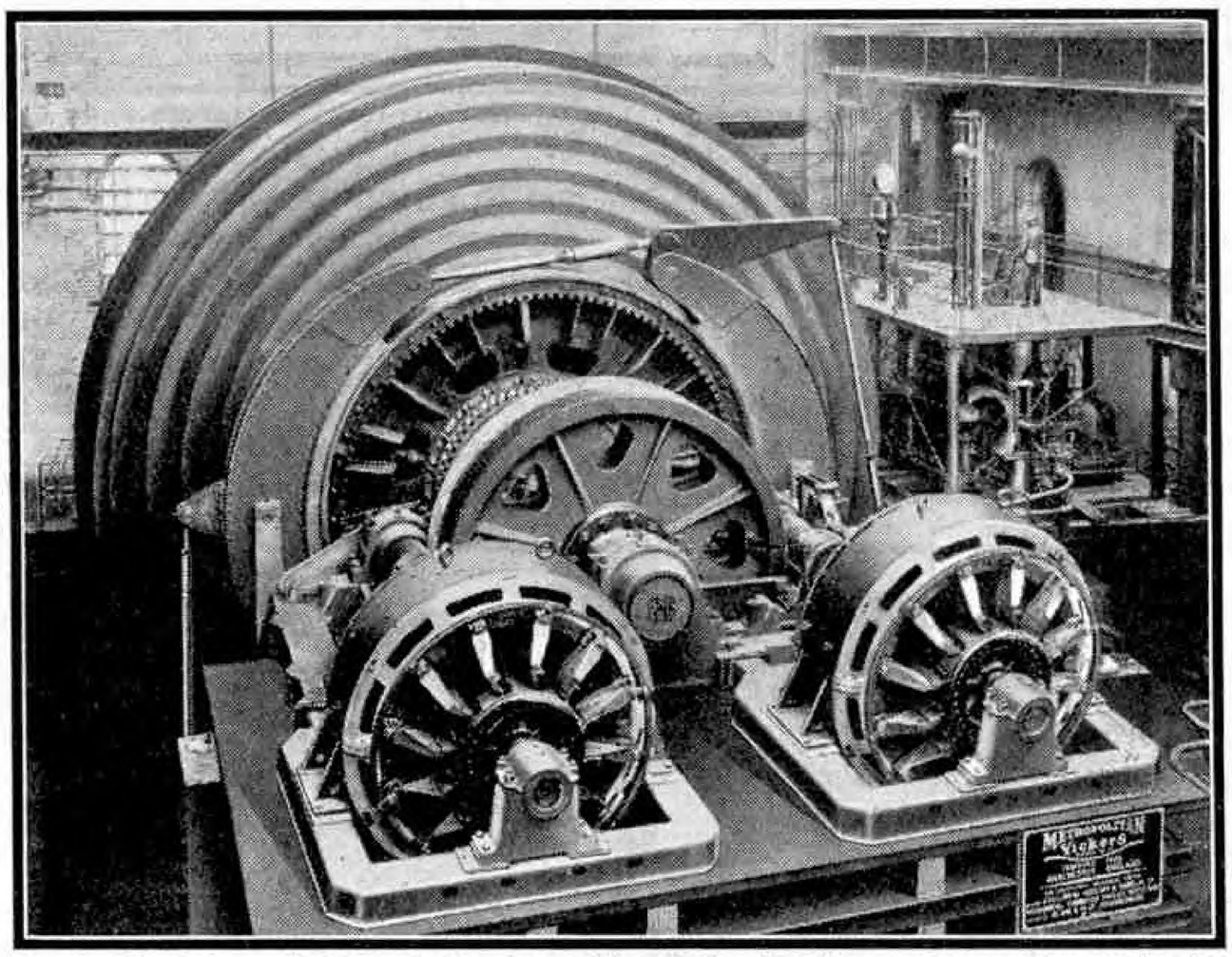
Similar equipment is used in gold mines, and indeed wherever valuable products found in the depths of the Earth have to be raised to the surface through a shaft. Fascinating as it is to watch the great wheels spinning rapidly, it is still more interesting to see the powerful machinery that actually hoists the cages and to realise how it has been developed from the earliest days of mining. Then shafts were not very deep and a simple barrel or drum was sufficient for the single rope that supported the bucket or hopper in which ore was raised. The first improvement on this simple scheme consisted in winding two ropes on the drum in opposite directions and providing each with a bucket. As the drum was turned one bucket then was raised while the other was lowered. Thus the rate of working was doubled, and the task of hoisting was made easier, since the weights of the two buckets balanced each other.

As the depths of pit shafts increased, longer ropes or cables became necessary and eventually the weight of the cable itself became a matter of importance, for it produced an over-balancing effect that added to the difficulties of starting and stopping. For this reason, a new form of drum with conical ends has been introduced. In one type the central portion of the drum is cylindrical and the earlier turns of the cable supporting a cage that is being hoisted are wound on a short portion of small diameter, those following passing round the continually increasing diameter of the conical section until eventually the cylindrical part in the centre is reached. The effect of this may be compared to the use of low gearing in a motor car on starting, when power rather than speed is required. In the case of the conical winding drum, the speed at which winding begins is comparatively low, and increases as the cable winds itself round the conical portion, reaching its highest when the central cylindrical section comes into operation.

As the design of winding equipments was improved, their power was increased in order to enable them to cope with demands for greater production. Modern winding machinery is capable of dealing with heavy loads, and of drawing them from immense depths at very high speeds. This is well shown by the plant of which the winding unit is illustrated on this page. This forms part of the hoisting machinery built for the Simmer and Jack Gold Mines Ltd., part of the New Consolidated Coalfields of South Africa. There are actually three winders in the winder house of this mine, all of the same size as the one illustrated. They hoist three pairs of skips, each of which weighs 9,000 lb., and the weight of rock lifted in each skip is 16,000 lb. These immense loads are raised from a depth of 6,600 ft., which is greater than that to which any winder previously constructed works, and the speed at which they are carried upward is 3,000 ft. per min. throughout the greater part of the lift.

Of the three winders, one is used for raising or lowering men and the other two for rock, and all six skips work in the same shaft. The equipment is electrical in operation, and was constructed by the Metropolitan Vickers Electrical Co. Ltd., the mechanical parts being manufactured by Fullerton, Hodgart and Barclay Ltd., Paisley.

For convenience the winding unit of this equipment is constructed in two parts, and our illustration shows one of the two drums of which it consists, together with the motors that drive them. The second drum is behind the first. Each weighs 127 tons and is built up from 58 cast steel sections secured by means of 550 filed bolts. The smallest diameter is 13 ft. and the greatest is 35 ft., and some idea of the immense size of the two drums is given by a comparison with the control platform, seen on the right in the accompanying illustration, where an engineman can be distinguished in the act of moving one of the control levers.

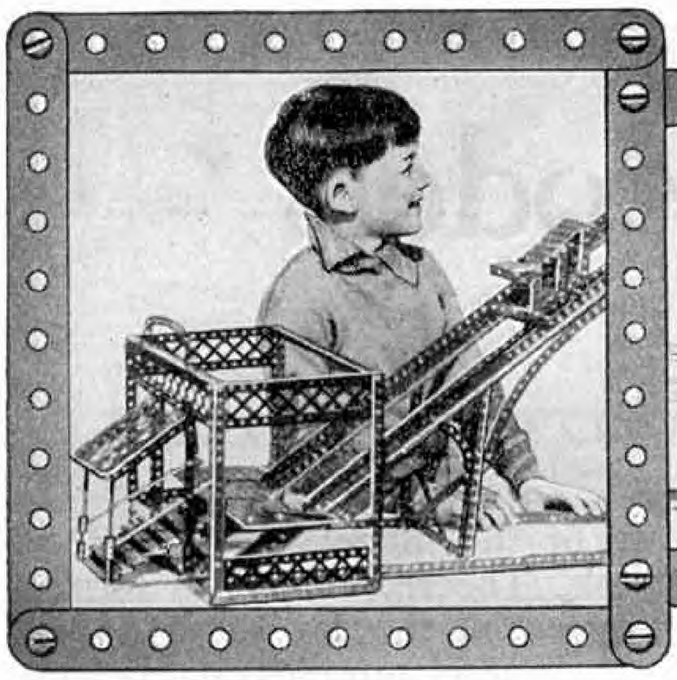


**An electric winder, with 35 ft. winding drums driven by two 3,300 h.p. motors, constructed for the Simmer and Jack Mines of New Consolidated Goldfields Ltd., South Africa. Photograph by courtesy of Metropolitan Vickers Electrical Co. Ltd.**

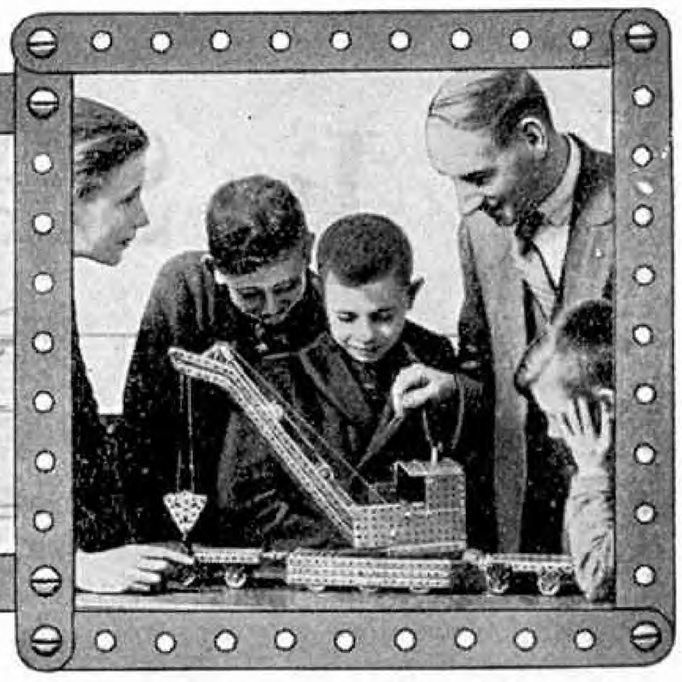
A cable from the shaft passes over each of the two drums of the winder unit, and these of course rotate in opposite directions when winding is in progress. In each case the end of the cable is attached to the narrow end of the drum and is wound up when this rotates in the appropriate direction. The first four or five turns can be accommodated on the narrow end, but as the momentum increases the cable is guided on to a spiral path on the conical section and thus is transferred to the larger diameter. Actually the cable is wound up along a spiral groove beginning at the narrow end of the drum and passing up the scroll, or spiral path on the conical section, to be continued along the cylindrical portion. The groove is carefully shaped to enable the lower half of the cable to fit into it, so that the latter forms a single layer on the drum and is subjected to as little wear and tear as possible. The steel cables used are 2 in. in diameter and weigh nearly 7 lb. per foot.

The winder unit is driven by two electric motors, each of 3,300 h.p., that are supplied with direct current at 660 v. by special motor generator sets and run at 225 r.p.m. They act through pinions to drive a large helical gear wheel that is 12 ft. 6 in. in diameter and has a face 3 ft. 4⅝ in. in width. The great main shaft carrying this wheel has a length of 37 ft. and a diameter of 2 ft. 4 in. It alone weighs 33 tons, although it has a 6 in. hole running right through it from end to end. The shaft passes through the two winder barrels and is supported by four self-aligning bearings. The drums are loose on the shaft, and are driven by means of a toothed clutch 8 ft. 4 in. in diameter that has 60 teeth.

The winding drum of hoisting equipment of this kind must be capable of exact control and very powerful brakes therefore are fitted to it. Each section is provided with braking gear and the drum of one of these, together with its immense brake shoes, can be seen immediately behind the gear wheel in our illustration. The drums are 18 ft. in diameter and 2 ft. wide, so that they provide a large and efficient braking surface. The shoes are applied by means of an engine consisting of a cylinder fitted with a piston that pushes a weight upward as oil is forced beneath it. The oil is released when the brakes are to be brought into use, and the fall of the piston then gives a steady controlled braking pressure. If this becomes too great a governor slows down the rate at which oil is released. Violent braking that might cause injury to men in the cages therefore is avoided. In addition many safety devices are fitted to protect the equipment.



# WITH THE MODELBUILDERS



## ASTRONOMICAL MODELS

There is intense fascination in following the movements of the Earth round the Sun and the Moon round the Earth in a model that reproduces their relative rates of motion correctly. Meccano is particularly well adapted to the construction of models of this kind, which are known as orreries, and an excellent Meccano orrery was described in the "*M.M.*" for June 1927. In it the Sun is represented by a celluloid globe mounted on a fixed vertical standard. The Earth and the Moon are represented by balls mounted on arms, one rotating round the standard carrying the Sun, and the other round the one supporting the Earth. An electric motor drives the apparatus through suitable gearing to give the required speeds, and the actual movements of the Earth and the Moon are reproduced in a very realistic manner.

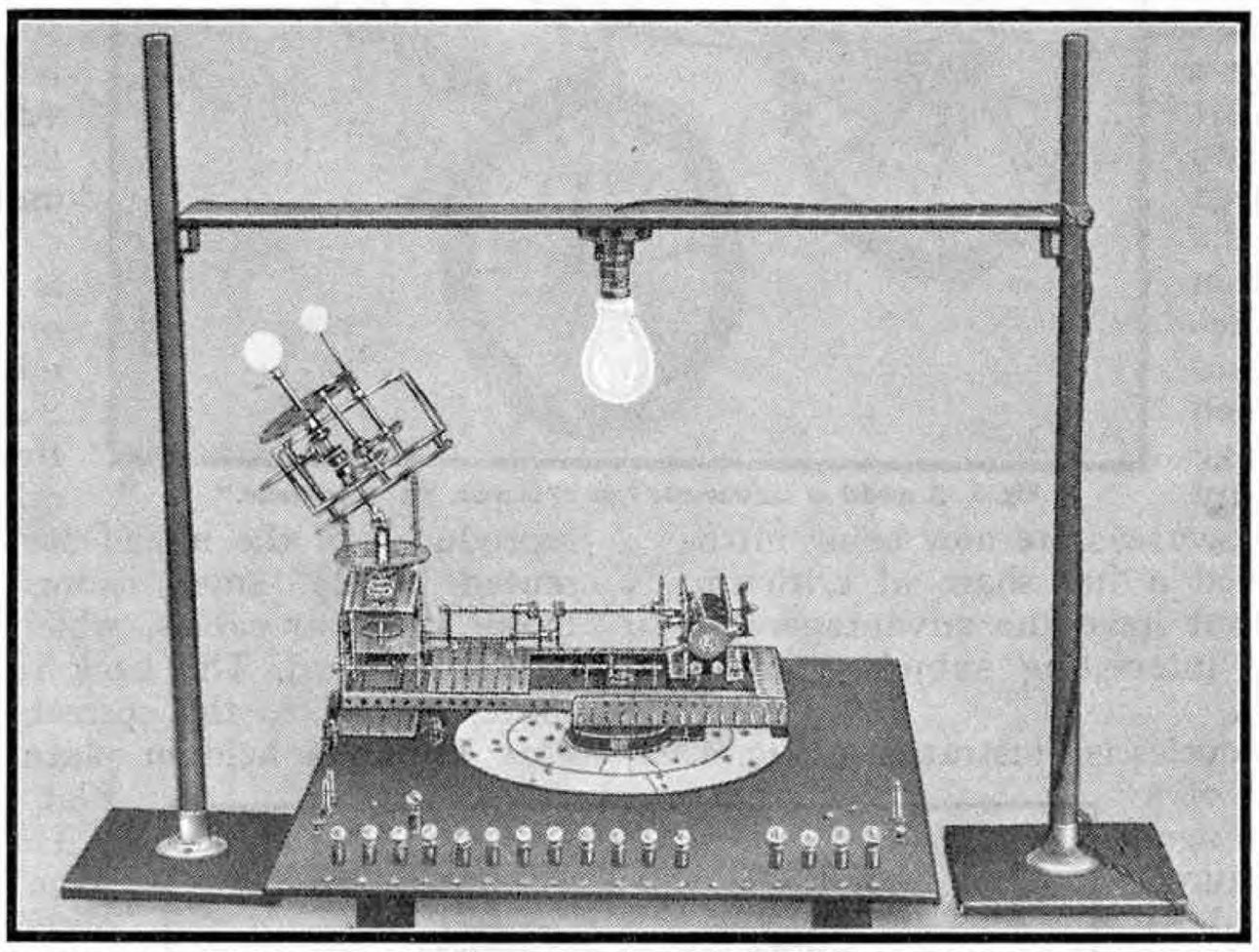
Similar models have been built by Meccano enthusiasts, and an interesting extension that might be suggested would introduce other planets, mounted on arms that would place them at their correct relative distances from the Sun, each driven at the appropriate speed round the centre of the system.

There is ample scope in models of this kind for novel and ingenious devices to illustrate the changes of the seasons and other events or happenings that depend on the motions reproduced in them. The model illustrated on this page shows one device of considerable interest that has been introduced not only to show how the seasons change, but also to illustrate the position occupied each month or season by the Earth during its annual journey round the Sun.

This fine model was built by Mr. J. Piesing, B.Sc., Manor Road Senior School, Wolverhampton. In general construction it follows the lines of the Meccano orrery already referred to. A Meccano Ball Bearing is secured to the centre of a stout board, and this supports one end of a strongly constructed arm that carries an electric motor and the structure supporting miniature representations of the Earth and the Moon. These move in their circular orbits in the correct manner, and it is fascinating to watch on the model the passage of a complete solar year in a very short time.

The novelty in Mr. Piesing's model is the use of lighted lamps to illustrate the succession of the months and the seasons. There are 16 lamps altogether, arranged in two groups of 12 and 4 respectively. Each of the lamps in the first group is labelled with the name of a month and is illuminated when the miniature Earth is in the correct position for the period it represents. Similarly the lamp for each season is lit up during the right period.

The mechanism by which this is done is simple, but interesting. Two brass slip rings are secured to the baseboard, and encircle the Ball Bearing. The inner slip ring is divided into 12 sections that are insulated from each other and are connected, in order, to the 12 lamps representing the months. The outer slip ring is similarly divided into four sections, each of which is connected to one of the lamps in the second group of four. Two spring brushes carried beneath the rotating arm make contact with the sections of the slip rings and complete circuits that illuminate the lamps in succession.



**The Meccano Orrery described on this page. The electric lights in front show the passing of the months and the seasons of the year by automatically lighting up for the correct periods.**

## TAKING ONE'S OWN PHOTOGRAPH

Now that the long sunny days are here, the ardent photographer will be looking for fresh fields to conquer with his camera. Here is a plan devised by M. Orde, Switzerland, that will allow him to take a photograph of himself. This is always an interesting achievement, and pictures of scenes in which the photographer himself is included are ideal mementos of enjoyable holidays as well as interesting novelties.

M. Orde's device takes the form of an automatic shutter release. A camera, preferably of the box type, is clamped to a simple framework built up from two 12½" and two 7½" Angle Girders. This framework carries the Clockwork Motor, the speed of which is controlled by a fan, as described in Standard Mechanisms No. 116. The driving spindle of the Motor is connected by a step-down gear train to a horizontal Rod mounted, as far away from the camera as possible, in Flat Trunnions, and on the Rod is wound a length of Cord the free end of which is attached to the shutter lever of the camera.

The Cord is allowed to hang in a loop between the horizontal Rod and the shutter lever, and the Motor is wound up. When all is ready the Motor brake is released and the photographer moves to his pre-arranged position. The Cord is slowly wound up until it is tight and the shutter of the camera is released after a period of time that is governed by the amount of slack. A few trials will show how much slack must be allowed.

## ROAD WHEELS FOR TRACTORS

A small model tractor that received a prize in a recent "Simplicity" Model-building Contest is of outstanding interest because of the means adopted to represent the large rear wheels. In the model these wheels consist of Townend Rings, Meccano Special Aeroplane Constructor Part No. 201, and the remainder of the structure is built to a scale corresponding to their size. The wheels are lock-nutted on opposite ends of a short threaded rod that is journalled in suitable bearings in the sides of the model tractor.

The rear wheels of many real tractors have projecting flanges crossing their treads at an angle. These can be realistically reproduced in small models by using 1½" Helical Gears, Part No. 211b, as wheels, for their teeth are curved in a similar manner.

## MECCANO AIDS FOR THE WOODWORKER

Miniature cabinet makers and woodworkers in general can make good use of Meccano parts, for these are admirable for strengthening purposes, and also can be applied to advantage in actual constructional work. For instance, ½"×½" and 1"×1" Angle Brackets can profitably be fitted into corners and to corner posts. When used in this manner they save trouble in cutting and shaping special pieces of wood, and also add considerably to the strength of the work. Angle Girders and Girder Brackets can be used in a similar manner. It is a good plan to sink these parts slightly into the wood, and the necessary recesses can easily be made by means of a few judicious saw cuts and a little careful chiselling.

Sometimes it may be desirable to conceal the strengthening pieces. In that case they can be covered with a thin layer of plastic wood, and a perfect finish combined with maximum strength is obtained if this layer is carefully applied and sand-papered when thoroughly set.

Meccano parts also can be used in the construction of handles. One form can be made by securing Handrail Supports or Handrail Couplings to the woodwork and fitting in them the ends of Meccano Rods bent into any desired shape. Dredger buckets also make excellent small handles for similar purposes. These of course are fitted with their openings downward and fine screws are passed through the twin slots at the back and into the woodwork.

Other simple handles are formed by securing Double Angle Strips to the woodwork by means of ½"×½" Angle Brackets, the connections between the Double Angle Strips and the Angle Brackets being made by lock-nutted bolts. Crankshafts in conjunction with Handrail Supports also can be used for the same purpose.

## A TURNTABLE FOR A WIRELESS RECEIVER

A little ingenuity will suggest other uses for Meccano parts in coping with the little problems that so often confront the woodworker. An interesting example of this occurred recently when the owner of a portable wireless set wished to construct a substantial turntable for it. A set of this kind is directive and must be turned so as to secure the best results from transmitting stations in various directions.

The base of the turntable designed for use in this case is a piece of wood, 12" sq. and 1" in thickness, to which the lower half of a Meccano Ball Bearing unit consisting of a Flanged Disc, was screwed. The upper portion of the ball bearing unit, a Geared Disc, was attached in a similar manner to the underside of the wireless set. A Bush Wheel was fitted in the centre of the Geared Disc and a Rod was secured in its boss. A Ball Casing was placed on the lower portion of the Ball Bearing, and the Rod then was passed through the centre hole of the Flanged Disc, and also through a hole drilled in the 12" square of wood. A Collar sunk in the lower face of the wooden base was fitted on the lower end of the Rod, to hold the two halves of the Ball Bearing together.

## MECCANO WARSHIP ACCESSORIES

Much attention has recently been drawn towards naval matters, and this has had the effect of increasing interest in battleships, cruisers, and other vessels of the navy as subjects for model-building. Many suggestions for warships' fittings have been brought to our notice and these include the introduction of special funnels, ventilators, guns, and ships' boats.

Funnels are readily made from the present Meccano Funnels (part No. 138). If desired, these can be painted either light or dark naval grey. A piece of fine mesh wire gauze inserted in the top of the funnel, and held in place either by solder or Seccotine, could be used to represent the cinder catcher that in practice is necessary because of forced draught. Funnels for larger models can readily be made from specially painted Boilers that are secured to the deck of the ship by Angle Brackets, and to them can be bolted miniature searchlight platforms and sirens. Other naval accessories were described in the "*With the Model-Builders*" Section of the "*M.M.*" for November 1932.

# In Search of New Models

## Building Model Bicycles

EVERY boy loves a bicycle, and it is only natural that a model-building enthusiast should be attracted by the idea of constructing a miniature machine, especially if this will work like the one he rides. This opens out a really attractive field, for a beginning can be made with very simple but effective models built with small Outfits, and this can be followed by the construction of larger and more interesting representations that include reproductions of details of actual machines.

In some countries the design of bicycles is adapted to local conditions and the resulting machines often have a quaint appearance. Apart from this, really novel and interesting designs have been produced, especially on the Continent. In Great Britain there has been steady progress towards lighter and more reliable machines, which in general appearance have remained unaltered for many years, but novelties from overseas are now being introduced. These have received a full share of criticism, favourable and adverse, but have the advantage that they make exceptionally interesting subjects for reproduction in model form.

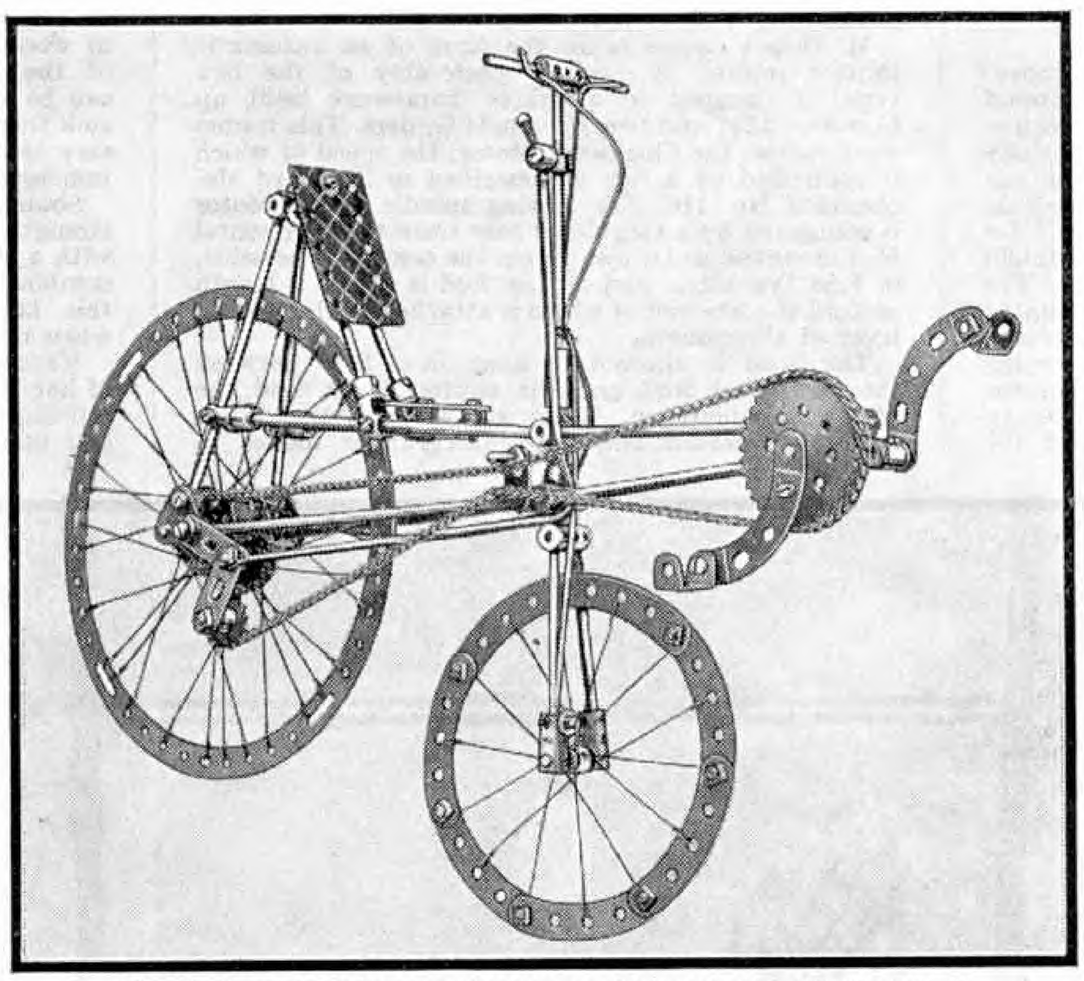


Fig. 1. A model of an unusual type of bicycle, the "Cycloratio."

One of these unusual bicycles is illustrated in Fig. 1. It is a scale reproduction of a Cycloratio machine, a strange-looking bicycle manufactured by the Cyclo Gear Co. Ltd. It may be added that this company a few years ago introduced another novelty into this country in the Derailleur Gear, an interesting bicycle gear mechanism that was fully described and illustrated in model form in the "*M.M.*" for October, 1931.

The rider of a Cycloratio machine does not sit upright, but reclines gracefully against a back rest, with his feet projecting forward and actuating cranks fitted in front instead of between the wheels. The machine is claimed to be more efficient than the usual design, and one fitted with an 8-speed Cyclo Gear recently put up a creditable performance in the "Concours Des Alpes," a 405-mile race over mountain roads. The Meccano model is based on this machine, but the Cyclo Gear is not reproduced and the gearing fitted to represent it does not work in the same manner.

An interesting feature of the model is the method of constructing the wheels. The rear wheel is formed from a Circular Strip, representing the rim, and two Bush Wheels, representing the hub. The rim of the front wheel is built up from $2\frac{1}{2}$" Curved Strips. In each case the spokes are of 22 S.W.G. Copper Wire, fitted as shown in Fig. 1. Each spoke is passed through one of the holes in the Bush Wheels and its end fixed there by twisting, and the other end is secured to the rim in a similar manner after the wire has been straightened by stretching. A wheel of this design is remarkably strong and very easy to "true up."

The frame of the bicycle is built up from a number of Rods joined together by means of Couplings and Swivel Bearings. Other interesting features of the original machine that are reproduced in the model are its curved cranks, represented by $2\frac{1}{2}$" small radius Curved Strips, and the brake and gear cables, which are indicated by lengths of Spring Cord. The back rest is a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate, curved to the correct shape, and the seat is a Flat Trunnion held in place by a $1\frac{1}{2}$" Strip and two Flat Brackets.

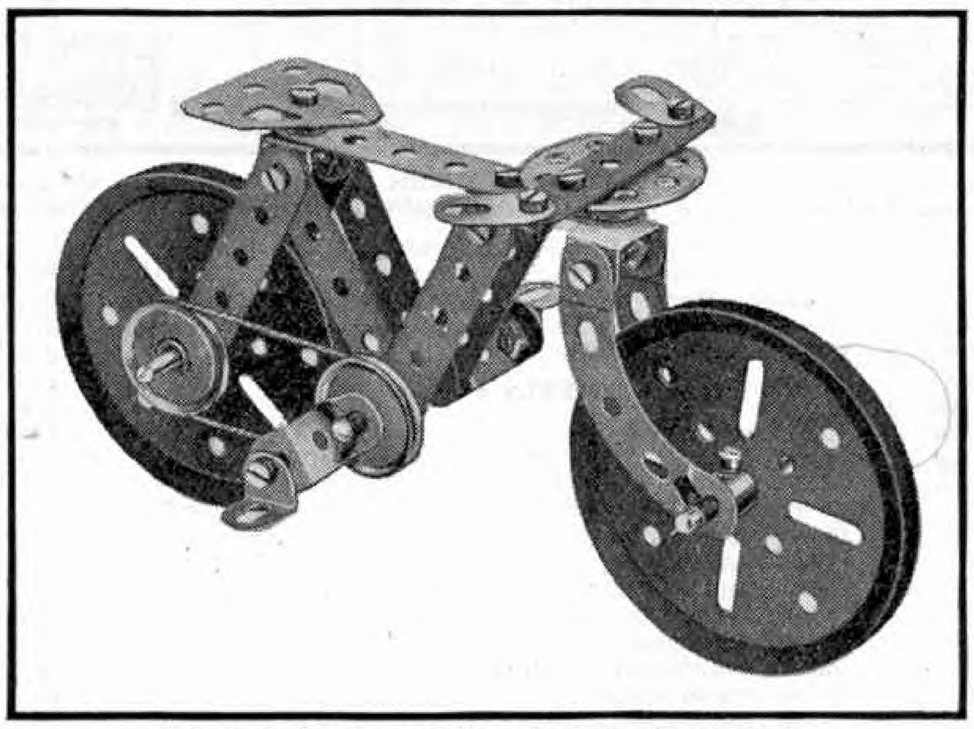


Fig. 2. A simple model bicycle built with Outfit B.

The early days of cycling have much to offer to the observant model-builder, and many interesting models can be made of pioneer machines. One of the very earliest was the dandy horse, which was merely a cast iron frame fitted with two wheels, and had no pedals. The rider sat astride a bar and propelled the machine by striking the ground with the feet in a kind of walking or running movement. This forms an excellent subject for small outfit model-builders. Later came the "penny-farthing," which had a small wheel behind a very large one. Many clever and often humorous reproductions of this have been illustrated from time to time in Manuals and the "*M.M.*" It is interesting to note that the Cycloratio bicycle resembles a "penny-farthing" in having wheels of different sizes, but in this case the small wheel is in front.

Fig. 3 illustrates a simple model of an early tricycle that can be constructed with a small outfit to which Artillery Wheels are added. The frame of this model is very simple, consisting of a series of short strips connected together in the manner shown. The method of representing the handle bars is worth noting. These are made of two Pawls, without bosses, secured to two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets on the frame. If desired, the pedals and front forks can readily be made to work as in actual practice.

The introduction of the "safety" cycle did much to standardise the design of bicycles, and for a period of about 40 years they have had the appearance typical of most modern touring machines. Heavy frames, deep section mudguards and chain cases are the outstanding features of these, and the careful use of Curved Strips and some of the smaller Flexible Plates in reproducing them should result in first-class models.

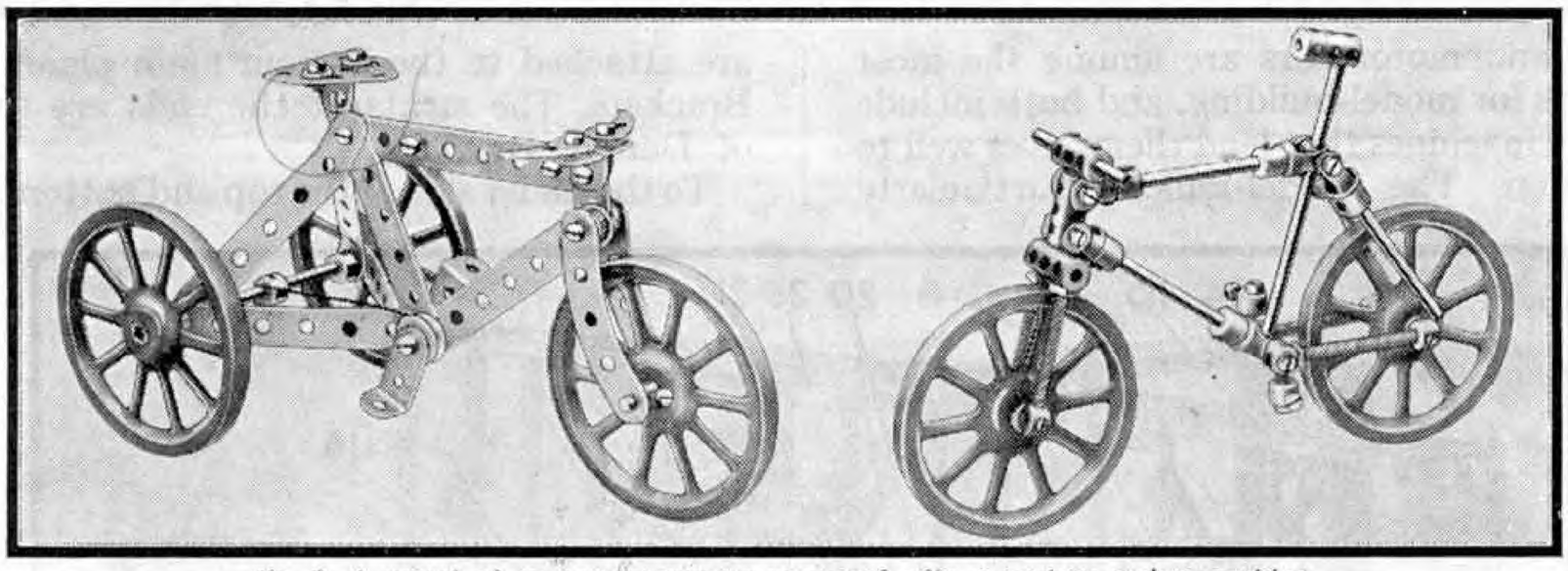


Fig. 3. A model of an ancient tricycle compared with a modern racing machine.

With the coming of the craze for lightness and speed, cycle manufacturers introduced a variety of "light-weights." All Meccano model-builders will be familiar with these and will doubtless appreciate the clever reproduction, in model form, illustrated in Fig. 3. Although this is not built accurately to scale it conveys the desired impression. The excessively high saddle, low handle bars, and straight forks are the most outstanding features. The frame is built in a similar manner to that of the bicycle shown in Fig. 1, but fuller use is made of End Bearings and Small Fork Pieces. At each point where a Small Fork Piece is used, set-screws with Washers placed under their heads form the required connections. Each pedal is represented by a "spider," in one of the holes of which is screwed a $\frac{3}{8}''$ Bolt supporting a Collar carrying a Bolt.

Larger scale models built up neatly in a similar manner look very effective. In these the wheels can be formed in the same manner as those fitted to the Cycloratio bicycle. Large scale models have the added advantage of giving greater scope for accuracy, and for the inclusion of many interesting accessories.

Tandems have become increasingly popular in recent years, and these form particularly interesting subjects for reproduction. A simple model tandem is shown in Fig. 4. Its frame is built up from Strips of various lengths, and the crossbar and bottom main member are built of duplicated $5\frac{1}{2}''$ Strips. The saddle supports are made of $3\frac{1}{2}''$ Strips. The inter-frame members and front forks consist of 3" and 2" Strips and the handle bars are 1" Threaded Rods. In this model good use again is made of Pawls without bosses, four being employed in building up each saddle. $1'' \times \frac{1}{2}''$ Angle Brackets represent pedals, and these are fitted in a similar manner to those of the model Tricycle.

An interesting addition that can be attached to all models of tandems takes the form of a small sidecar. The construction of this need only be of a very simple nature. A model so fitted has the advantage of being able to remain upright without supports. The introduction of figures built from Meccano parts also makes models more attractive and gives them a lively appearance. The construction of these can be quite simple, a few Strips for the limbs and body and a 1" loose Pulley for the head being all that is required to produce a really good effect. Much larger and more complete figures can be built by resorting to the bending of parts, but these are beyond the scope of the owner of small Outfits.

All the models illustrated are fitted with cross bars, but it is a simple matter to convert any of them into a lady's machine by removing the cross bar and doubling the down member from the head-lock to the bottom bracket. Tandems also can be treated in this manner, but in this case only the rear half need be altered.

A special type of bicycle that can readily be built with Meccano parts is the "triplet," in which provision is made for three riders. Machines of this type are seldom seen on the road, but are used on many tracks for the purpose of "pacing." When building a model "triplet" a very strong frame should be constructed and for this duplicated Strips can be used to advantage.

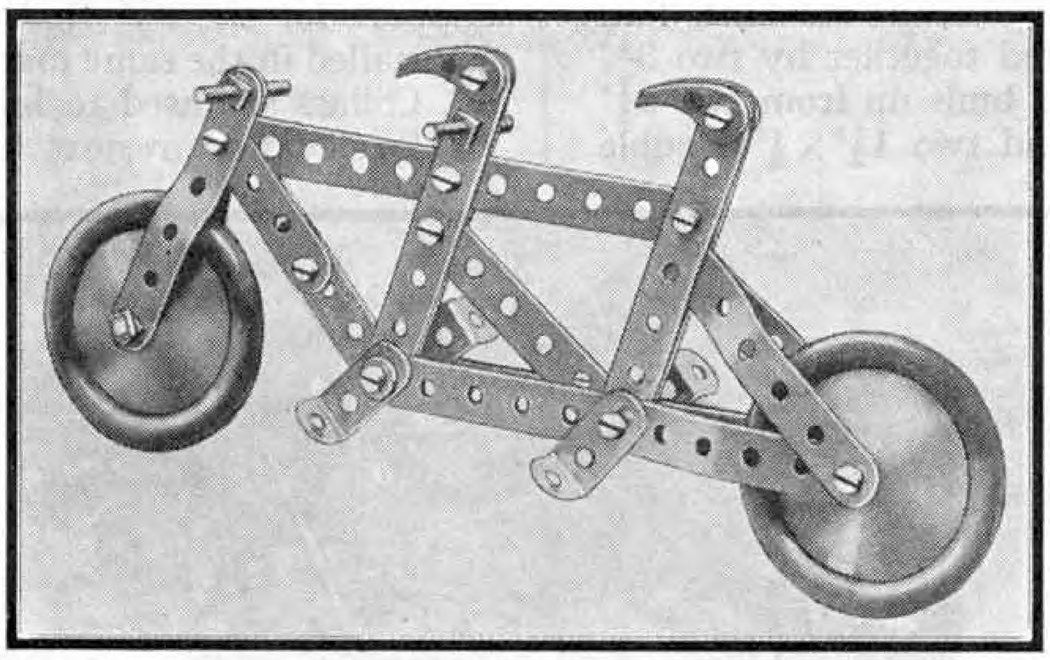


Fig. 4. This simple model of a tandem machine is easy to make and is effective in appearance. Its construction is described in the accompanying article.

Model-builders in search of novel subjects could reproduce the Auto-wheel, a small power unit designed for fitting to cycles that at one time was popular. This consisted of a separate wheel, of about the diameter of a bicycle wheel, that was driven by a small single-cylinder petrol engine. The petrol engine drove the Auto-wheel through a leather belt and the entire unit was so built that it could be clamped to the frame of any bicycle close to the rear wheel. The engine was started by pedalling.

An auto-wheel can be reproduced easily with the aid of only a few Meccano parts. The wheel is best represented by an Artillery Wheel, and the cylinder by a Worm. The necessary framework is built up from Rods and Small Fork Pieces in a similar manner to the model light-weight bicycle. The petrol, air and ignition controls can be represented by Collars, fitted with bolts and secured to the handle bars. Lengths of Spring Cord connect them with the engine of the auto-wheel.

# Two Meccano "Old Timers"

## The Wright Biplane and an Early Motor Car

AEROPLANES and motor cars are among the most popular subjects for model-building, and both include a very wide range of machines that lend themselves well to realistic reproduction. The model-builder particularly enjoys building models of modern cars or aeroplanes, but equally good fun can be obtained by reproducing old time examples, many of which are noteworthy for their quaint and unusual appearance as well as for their historical interest. The two models dealt with in this article are excellent instances of this. One of them is a reproduction of the biplane in which the Wright Brothers made the first controlled flights more than 30 years ago. The other represents one of the earliest motor cars to be used in this country.

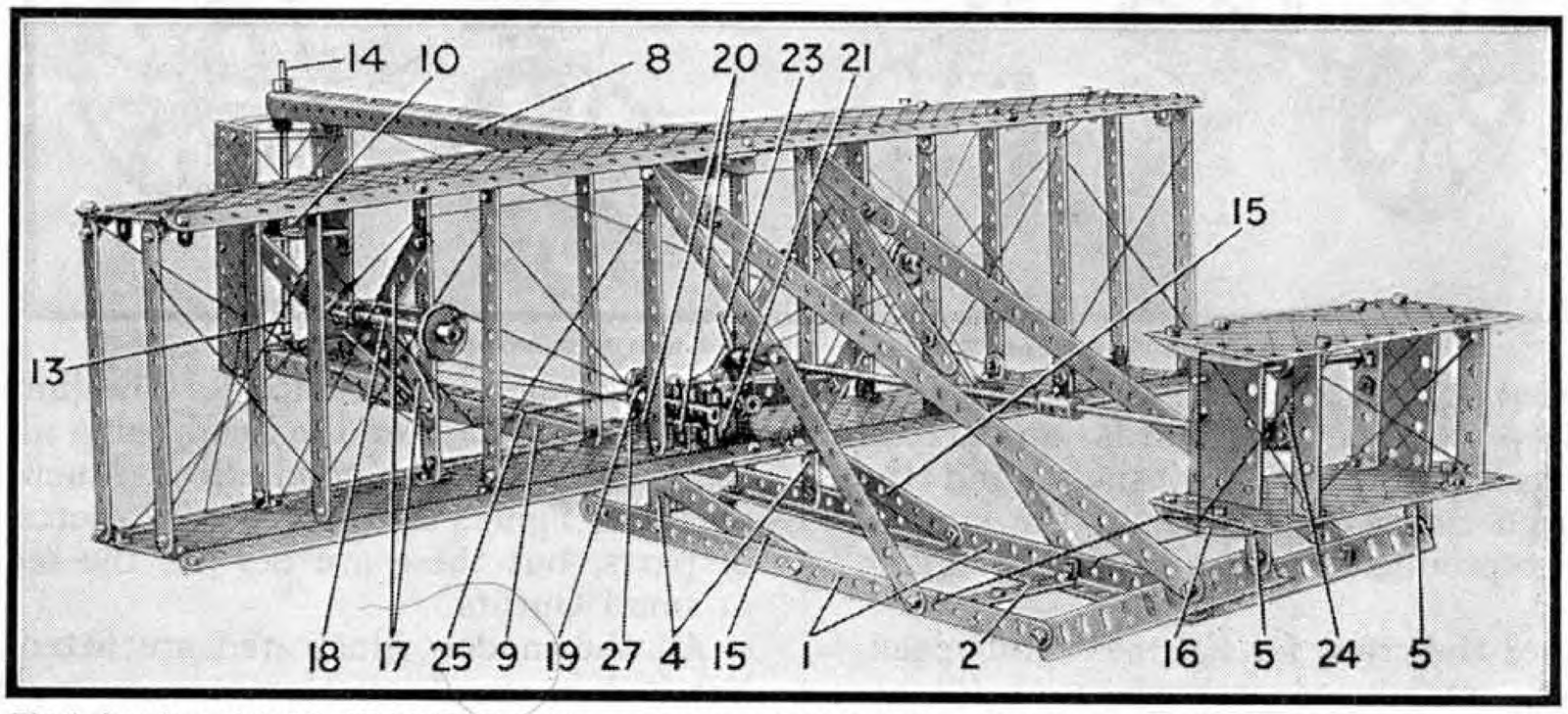



**Fig. 1. A scale model of the Wright Biplane. The construction of this "old timer" is fully described in the accompanying article.**

Construction of the model of the Wright Biplane is begun by building the simple fuselage of the machine. Two $12\frac{1}{2}''$ Angle Girders 1 are connected together by two $3\frac{1}{2}''$ cross members 2, each of which is built up from two $2\frac{1}{2}''$ Strips overlapping three holes, and two $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips 3 are secured to the inner ends of the Angle Girders. Two angle members 4 also are fitted.

Two $5\frac{1}{2}''$ Angle Girders are fitted at the outer end of the Girders, as shown in Fig. 1, and to the top of these are bolted $1'' \times 1''$ Angle Brackets 5.

The lower main plane can now be built and fitted. This is formed from two $12\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plates overlapping three holes, and it is fitted with a $3\frac{1}{2}''$ Strip 6 in the middle and Flat Brackets at each end, as shown in Fig. 3. The purpose of the Strip and the Flat Brackets is to carry pairs of $12\frac{1}{2}''$ Strips that form the edges to the wing. The upper main plane is constructed in a similar manner, except that two additional $3\frac{1}{2}''$ Strips 7 are fitted for strengthening purposes.

The under side of the upper wing carries six $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, three on the leading edge and three on the trailing edge, as shown in Fig. 3. To these are bolted the upper ends of the interplane struts, the lower ends of which are attached to the bottom main plane by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. The struts at the ends are secured by means of Double Brackets.

To the under side of the top and bottom planes are bolted long compound girders 8 and 9. These two members form the trailing section of the fuselage. This carries the two rudders, which are represented by $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates, placed vertically and joined together by means of four $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. Two of these Double Angle Strips are shown at 11, Fig. 3, and carry a Double Bent Strip 10, Fig. 1, and a Flat Bracket 12, Fig. 3. The Flat Bracket supports the upper end of a $3\frac{1}{2}''$ Rod 13, the lower end of which is journalled in one of the Double Angle Strips joining the rudders and the end of the member 9. The Double Bent Strip 10 forms a support for the $3\frac{1}{2}''$ Rod 14, the upper end of which is journalled in the same manner as the lower end of the Rod 13. Collars are used to hold both Rods in position.

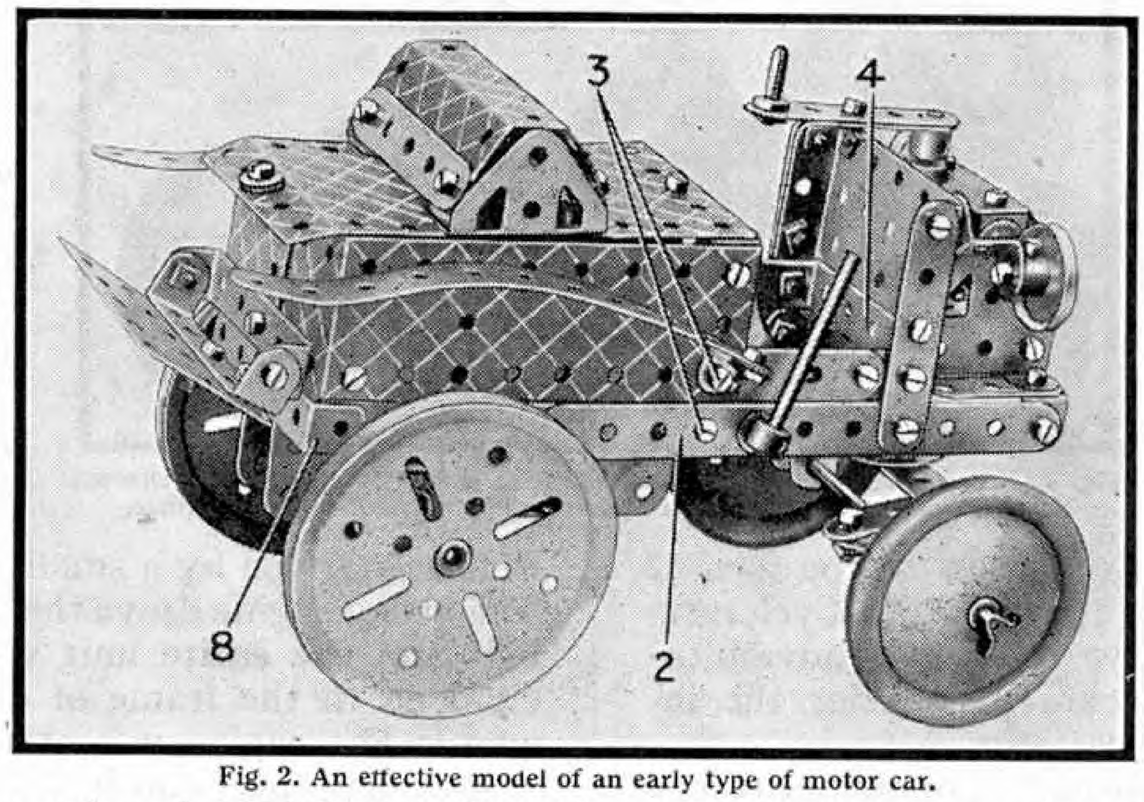



**Fig. 2. An effective model of an early type of motor car.**

The elevators are next fitted and it should be noted that, contrary to modern practice, these are placed forward of the main planes. A $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plate is first bolted to the $1'' \times 1''$ Angle Brackets 5. This Plate carries two $2\frac{1}{2}''$ Small Radius Curved Strips 16 and 16a, and also four $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, to two of which are bolted two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates.

The propeller shafts are carried in frameworks secured to two of the interplane struts. Each is built up in the following manner. Two $2\frac{1}{2}''$ Strips 17, Fig. 1, are secured to the third rear strut from the outer ends of the planes. The Bolt joining these two Strips also holds one end of a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip carrying a $3\frac{1}{2}''$ Rod 18 that forms the propeller shaft. This has secured to it at one end a $1''$ fast Pulley and at the other a Coupling. The Coupling is fitted with two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets that carry $3''$ Strips representing the propeller blades.

The $1''$ Pulleys on the propeller shafts are connected

by belts of cord to a $\frac{1}{2}$" Pulley 19 that forms the flywheel of the dummy four cylinder engine, consisting of two Couplings carried on a horizontal $2\frac{1}{2}$" Rod. Four Washers are placed on the Rod between the two Couplings, which are secured by set-screws to two Double Bent Strips 20. The four cylinders of the engine are represented by Collars held in place by $\frac{3}{8}$" Bolts.

The controls can now be fitted. A $2\frac{1}{2}" \times 1"$ Double Angle Strip 21 is first bolted to the lower plane to support a $3\frac{1}{2}$" Rod carrying a Coupling and a Collar 22, Fig. 3. The control column 23 is fitted to the Coupling by a Small Fork Piece, and a Swivel Bearing connects it to a compound rod. A second small Fork Piece is free to turn on the outer end of the compound Rod and is prevented from sliding off by means of a Collar. A nut, carried on a bolt passed into one hole of the Small Fork Piece prevents this part from sliding down the compound Rod by bearing lightly against the Collar already mentioned. This bolt also secures a Flat Bracket to the Fork Piece, and this is pivotally connected to the Crank 24. This Crank is secured on a Rod as shown and it represents the elevator control.

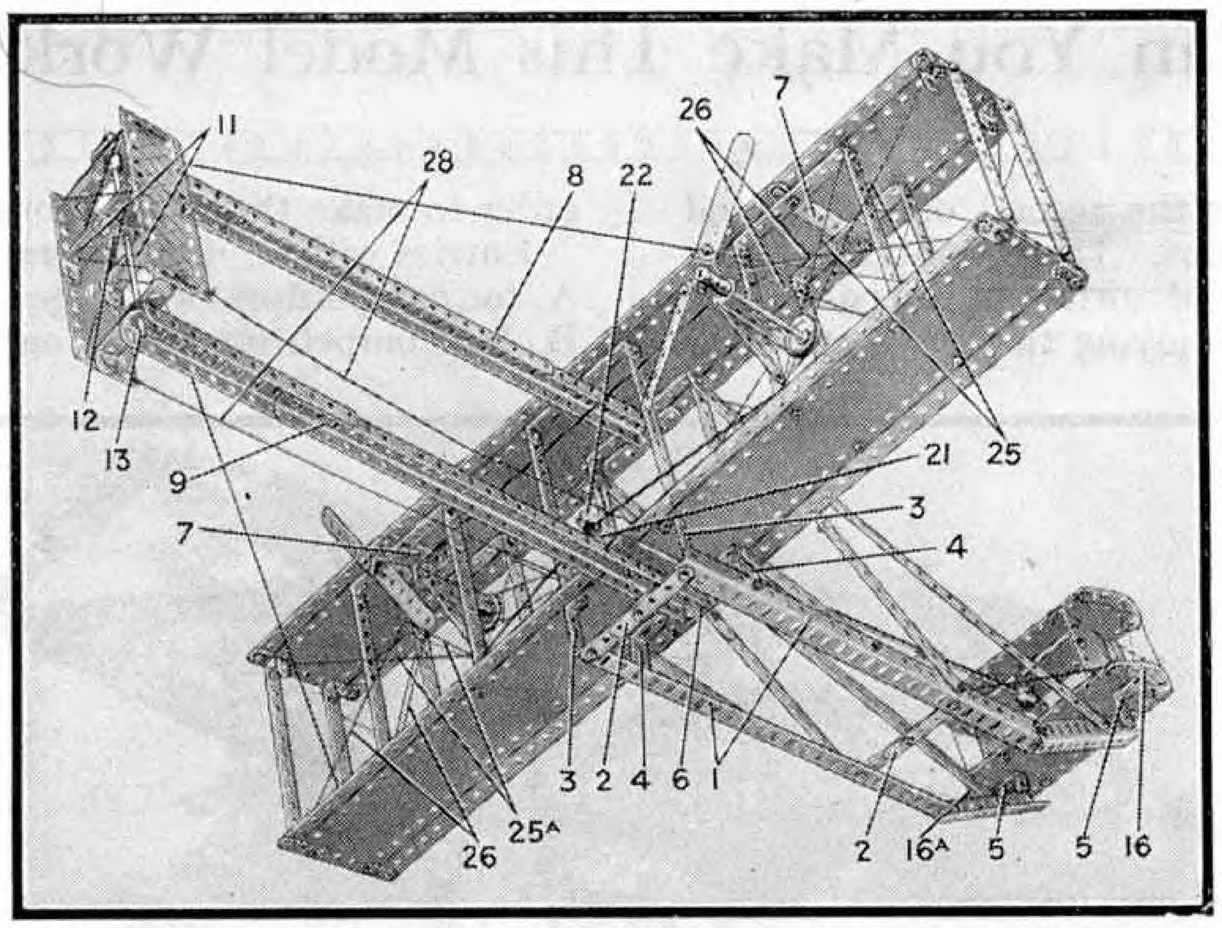



Fig. 3. An underneath view of the Wright Biplane illustrated on the opposite page.

Ailerons had not been invented when this machine was built, and the effect of banking was obtained by "warping" the wings. In the model this movement is obtained by moving the control column from side to side, thus rocking the Collar 22, carrying a Bolt. Two double cords 25 and 25a are used to connect the bolt to the ends of the upper plane. Two continuous cords 26 connect the two ends of the lower planes, and these pass through the top unoccupied holes of four interplane struts. The rudder bar 27, a $2\frac{1}{2}$" Strip, is coupled to the rudder by two cords 28.

List of parts required to build the Wright Biplane Model: 10 of No. 1; 20 of No. 2; 2 of No. 2a; 5 of No. 3; 6 of No. 4; 10 of No. 5; 2 of No. 6a; 8 of No. 8; 4 of No. 9; 5 of No. 10; 4 of No. 11; 22 of No. 12; 4 of No. 12a; 4 of No. 12c; 1 of No. 13a; 2 of No. 15b; 5 of No. 16; 1 of No. 17; 1 of No. 18a; 2 of No. 22; 1 of No. 23a; 2 of No. 35; 156 of No. 37; 6 of No. 37a; 22 of No. 38; 3 of No. 45; 1 of No. 46; 2 of No. 48; 10 of No. 48a; 6 of No. 48b; 8 of No. 59; 1 of No. 62; 6 of No. 63; 4 of No. 90a; 2 of No. 111; 6 of No. 111c; 1 of No. 116a; 2 of No. 165; 2 of No. 188; 2 of No. 189; 2 of No. 195; 4 of No. 197.

The second model can be built with D Outfit and is driven by a No. 1 Clockwork Motor concealed under the seats.

The side member 1 of the model consists of two $5\frac{1}{2}$" Strips overlapping seven holes. The other side member 2 is formed from two $5\frac{1}{2}$" Strips, also overlapping seven holes, but the rear strip is placed above the front one, the lower edge of the former resting on the upper edge of the latter. This arrangement is necessary in order to expose the winding spindle of the motor. The two Strips forming this side member 2 are held together by a Flat Bracket, secured in place by the bolts 3, and a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 4 fitted with two Flat Brackets.

The lower bolts 3 and the corresponding one on the opposite side of the model secure in place a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. This is fitted with a $\frac{1}{2}$" Reversed Angle Bracket 5 carrying a Double Bracket that is bolted between the side plates of the Motor. The Double Angle Strip also carries a $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate, forming the floor of the car, and in addition two $2\frac{1}{2}$" Strips 6 and 7 are fitted. The Strip 6 is attached by means of two Angle Brackets to the side members. The front hole of the Strip 7 carries the lower end of the steering column.

One end of the Motor is secured to the Bracket 5 as already described, and the opposite end is secured by a Double Bracket to the Double Angle Strip 8. This is bolted to the member 1. The axle carrying the rear wheels is journalled in the side plates of the motor and the drive is taken to a 1" Pulley on this by means of a Rubber Band from the motor driving shaft.

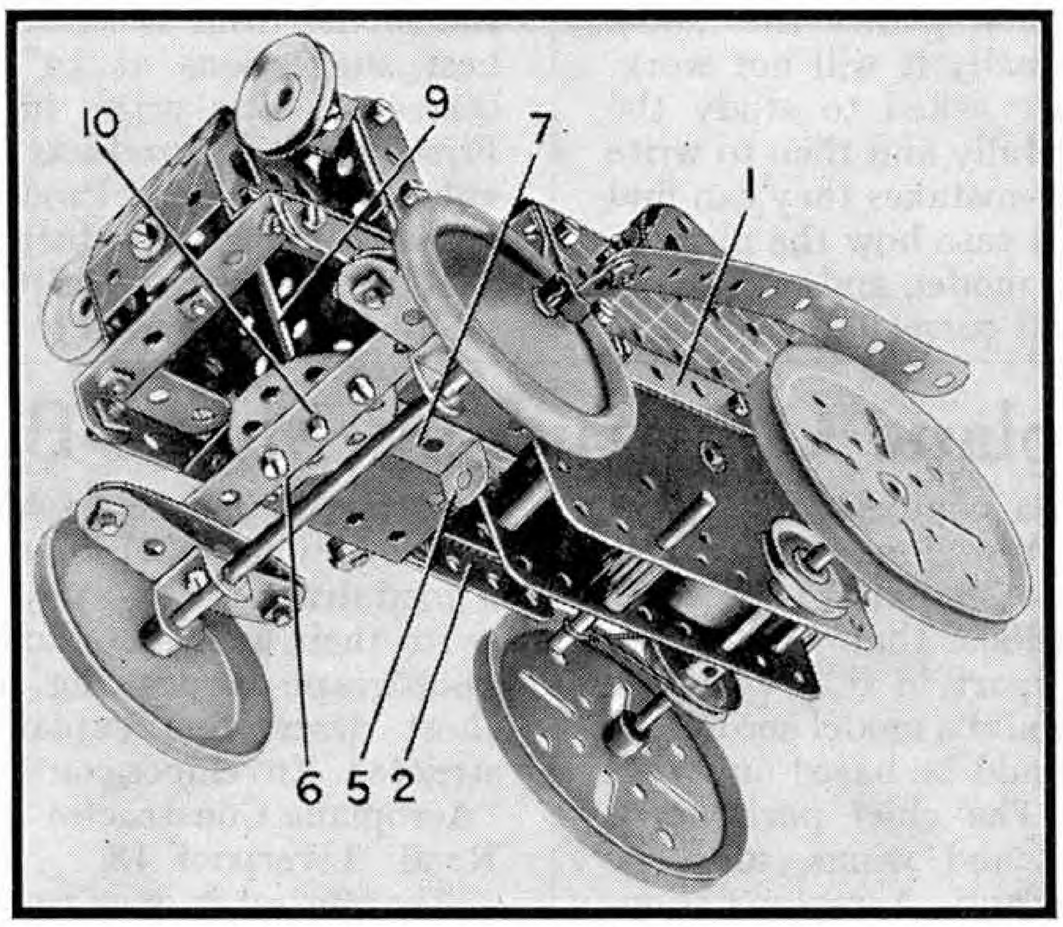



Fig. 4. This illustration shows how the power unit is fitted in the early model car.

The steering gear is arranged as follows. A $3\frac{1}{2}$" Rod 9 carries at its lower end a Bush Wheel to which is bolted two $3\frac{1}{2}$" Strips 10. Two $2\frac{1}{2}$" Strips are bent in the manner shown in Fig. 4 to represent the springs and fitted at each end of Strip 10. A Double Bracket secured to the lower member of each spring forms a bearing for the front axle on which the front wheels are free to rotate.

The "box" portion of the model represents the seats, and it consists of two $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates bent in the manner shown in Fig. 2. The front ends of these plates are joined by a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip that supports one end of a $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate. The other end of this Plate is held in place by an Angle Bracket. The back of the seats is secured in position by Angle Brackets.

List of parts required to build Model Car: 7 of No. 2; 2 of No. 3; 11 of No. 5; 2 of No. 6a; 7 of No. 10; 4 of No. 11; 12 of No. 12; 1 of No. 15; 2 of No. 16; 2 of No. 19b; 4 of No. 22; 1 of No. 24; 2 of No. 35; 65 of No. 37; 4 of No. 37a; 11 of No. 38; 1 of No. 48; 7 of No. 48a; 1 of No. 51; 1 of No. 59; 1 of No. 62; 2 of No. 90a; 6 of No. 111c; 1 of No. 115; 3 of No. 125; 2 of No. 126; 2 of No. 126a; 1 of No. 186; 2 of No. 187; 2 of No. 188; 2 of No. 189; 2 of No. 190; 1 of No. 191; No. 1 Clockwork Motor.

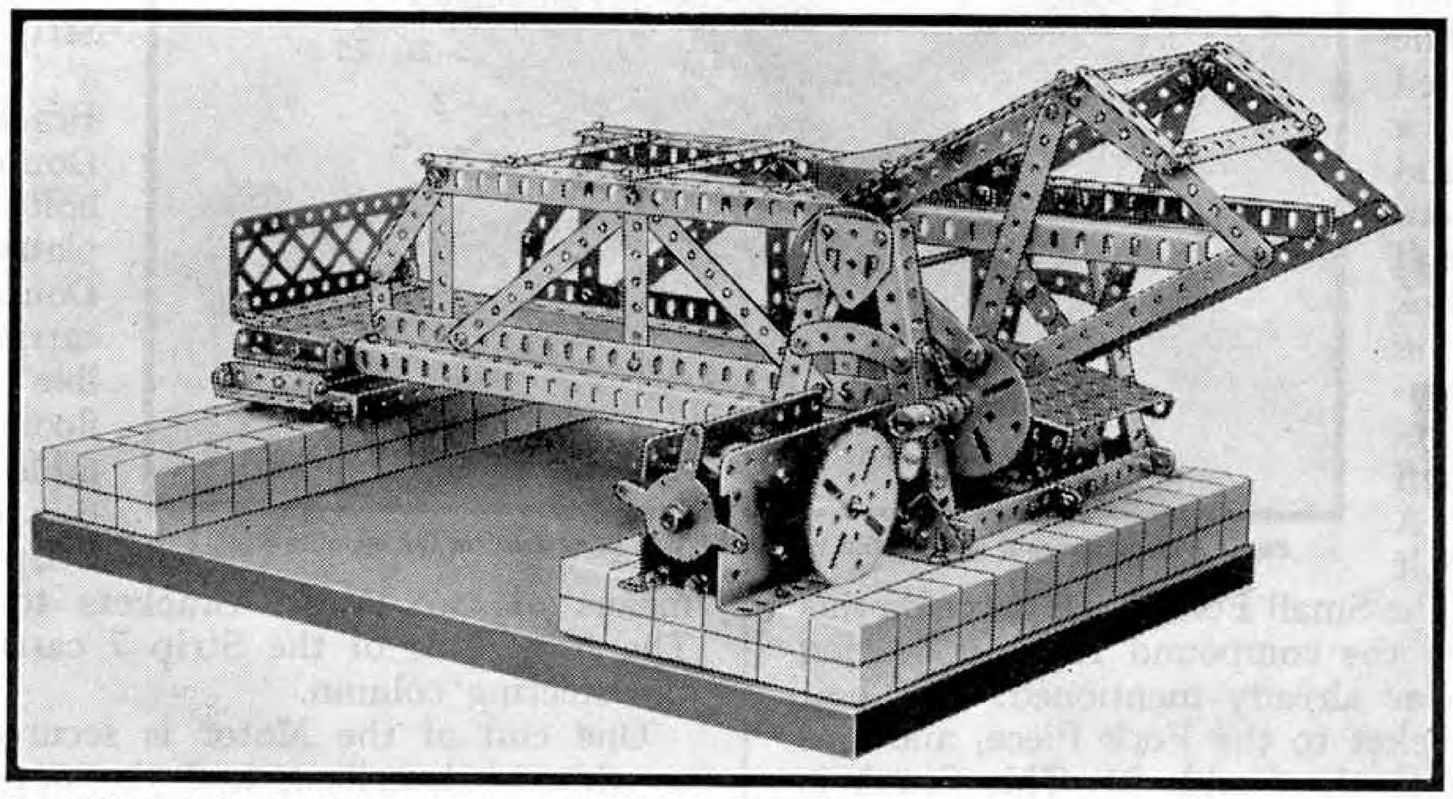
# Prizes for "M.M." Readers

## Can You Make This Model Work?

This month we announce the second of the special summer Meccano competitions. These Contests are of such a nature that boys and girls can prepare their entries just as easily while enjoying the fresh air out of doors as in the house. There is no model-building to do and no Meccano parts are required, the only things necessary being a good knowledge of Meccano model-building practice, a pencil and a sheet of paper. There are no restrictions as to age.

The model illustrated on this page is a reproduction of a rolling lift bridge. It was built by a boy who is familiar with the uses of the various Meccano parts, but possesses little mechanical knowledge, and consequently has made a number of mistakes in the construction of the model, some of which are so serious that although at first glance the model appears to be correctly built, actually it will not work.

Competitors in this contest are asked to study the illustration of the model very carefully and then to write on a sheet of paper a list of all the mistakes they can find in its construction, stating in each case how the mistake interferes with the working of the model, and explaining briefly how they themselves would correct each fault in order to make the model work properly.



**Several faults in the construction of this model lifting bridge prevent it from working. Several good prizes, details of which appear on this page, are offered to readers who can discover these mistakes.**

Entries will be divided into two sections as follows: A, for competitors of all ages living in the British Isles; B, for competitors of all ages living Overseas.

Each entry must bear the competitor's age, name and address, and letter A or B indicating the section for which it is submitted. Entries must be addressed to "Lifting Bridge Errors Contest," Meccano Ltd., Binns Road, Liverpool 13. Those for Section A must be posted in time to reach Liverpool before 31st August, 1936; the closing date for Overseas competitors entering in Section B will be 30th September, 1936.

Prizes will be awarded to those competitors in each Section who succeed in finding all the errors that prevent the model from working correctly, and who make the best suggestions as to how each mistake should be corrected. The prizes in each Section are as follows: First, Meccano Products value £2–2s. Second, Products value £1–1s. Third, Products value 10/6. There will be also five Prizes of Products value 5/–.

If no single competitor discovers all the errors the prizes will be awarded to the next best entries.

# Meccano "Aeroplane Constructor" Model-Building Contest

This month we are arranging a competition for the benefit of owners of Meccano Aeroplane Constructor Outfits. The present contest is similar to previous Aeroplane Constructor competitions that have been organised, and in order to take part in it a would-be competitor should set to work to build a model aeroplane. This may be of any type, but should be based on a real machine of well-known make. The chief portions of the model, that is the fuselage and wings, must be constructed entirely from Meccano Aeroplane Constructor parts, but a few ordinary Meccano parts may be used for reproducing small details or for representing special features of certain makes of machines. If preferred, however, models may be built entirely from Aeroplane Constructor parts.

Each model must be assembled by the competitor without assistance from anyone. Competitors may submit two or more models if they wish, but no competitor will be awarded more than one prize, and all models sent in by one entrant will be grouped together and judged on their joint merits.

The actual model must not be sent. A photograph or a good drawing is all that is required. Competitors must write their age, name and address on the back of each photograph or drawing submitted, and must enclose a short description explaining how the model is constructed. Envelopes containing entries must be addressed "Aeroplane Constructor Contest," Meccano Ltd., Binns Road, Liverpool 13.

The contest is open to competitors of all ages, living in any part of the world, and all entries must be forwarded so as to reach Liverpool on or before 30th September, 1936. The prizes to be awarded for the most interesting and original models received are as follows: First, Meccano Products value £2–2s. Second, Products value £1–1s. Third, Products value 10/6.

Photographs or drawings of prize-winning models become the property of Meccano Ltd., but unsuccessful entries will be returned, provided that a stamped addressed envelope is enclosed with the entry.

# Model-Building Competition Results

By Frank Hornby

## "Winter" Contest (Sections B and C)

The results in Section A of the "Winter" Competition were announced in the May issue of the "*M.M.*" and this month we give the lists of awards in Sections B and C. These are as follows:

**Section B (Home Competitors under 14)**

1st Prize, Cheque for £2/2/–: Alan Bunce, Harpenden, Herts. 2nd, Cheque for £1/1/–: Leslie Rhodes, Retford, Notts. 3rd, Products value 15/–: K. M. Hill, Huddersfield.

Products value 10/6: A. Dawson, Edinburgh; H. Beckett, Exeter; P. Shovelton, Worcester; W. Stiling, Exeter; C. Ramplee-Smith, Leigh-on-Sea; J. Mayo, London, S.W.16.

Products value 5/–: J. Gunn, Timperley; J. A. Scowcroft, Blackpool; C. B. Edmonds, London, S.W.16; R. Symons, Plymouth; D. Wills, Exeter; T. Patten, Edinburgh.

Certificates of Merit: K. Lack, Darley Dale, Matlock; J. Evans, Clowne, Derbys.; M. Kasmir, London, N.W.1; H. D. Munson, Marlow, Bucks.; D. Langdon, Exeter; J. Bulley, Exeter; E. Shapland, Exeter; N. Legg, Jarrow; A. Dick, Brighton.

**Section C (Overseas Competitors of all ages)**

1st Prize, Cheque for £3/3/–: P. J. de Proft, Willebroek, Belgium. 2nd, Cheque for £2/2/–: R. Myburgh, Capetown, South Africa. 3rd, Products value £1/1/–: J. Nie, Shanghai, China.

Products value 10/6: B. Van 't.Land, Groningen, Holland; Melvin J. Maddock, Carbonear, Newfoundland; J. Rombach, Delft, Holland; Pablo Giese, Buenos Aires; W. W. Dussel, Groningen, Holland; G. Whitfield, East London, Cape Province, S. Africa.

Products value 5/–: Lars Linder, Stockholm; M. Nicholls, Natal; Y. Willems, Hoboken, Belgium; G. Stanley, Johannesburg; R. Borland, Peterboro, Canada; C. Fishburne, Edmonton, Canada.

Certificates of Merit: L. Edwards, North Auckland, N. Zealand; M. Orde, Chateau d'Oex, Switzerland; H. Young, Port Elgin, New Brunswick, Canada; F. Hinbest, Toronto; N. Hanning, Calgary, Canada; E. Azzopardi, Sliema, Malta; E. Norton, Vancouver; E. Andersen, Manitoba; D. Swan, Oak Bay, B.C., Canada; D. McLeod, Calgary, Natal.

The model that won First Prize in this competition owes its success to originality of subject and to the way in which the simple parts employed in it have been used. The subject of the model is a bell buoy used for indicating shoals and rocks and other dangerous conditions in rivers and harbour entrances.

The portion of the buoy that normally is beneath the water is made from two Ring Frames and 12½" Flat Girders. The Ring Frames form the upper and lower rims of a pontoon, and the Flat Girders are used for filling in the sides and are held in place by Flat Brackets. The top of the buoy is formed with 5½" and 3½" Flat Plates, and to the upper Ring Frames are secured a number of 12½" Strips, which are connected together at their upper ends by means of a Bush Wheel and at the bottom by curved Flat Girders. Two circles also made from 5½" and 2½" Curved Strips are used to strengthen the structure. Four 1½" × ½" Double Angle Strips are bolted to the Bush Wheel and a second Bush Wheel is bolted to their opposite ends. A Rod fitted with a Handrail Coupling and pushed through the bosses of the two Bush Wheels supports the bell, which is made from 5½" Strips bent into U formation and bolted to a circle of Strips. The model was built by A. Bunce.

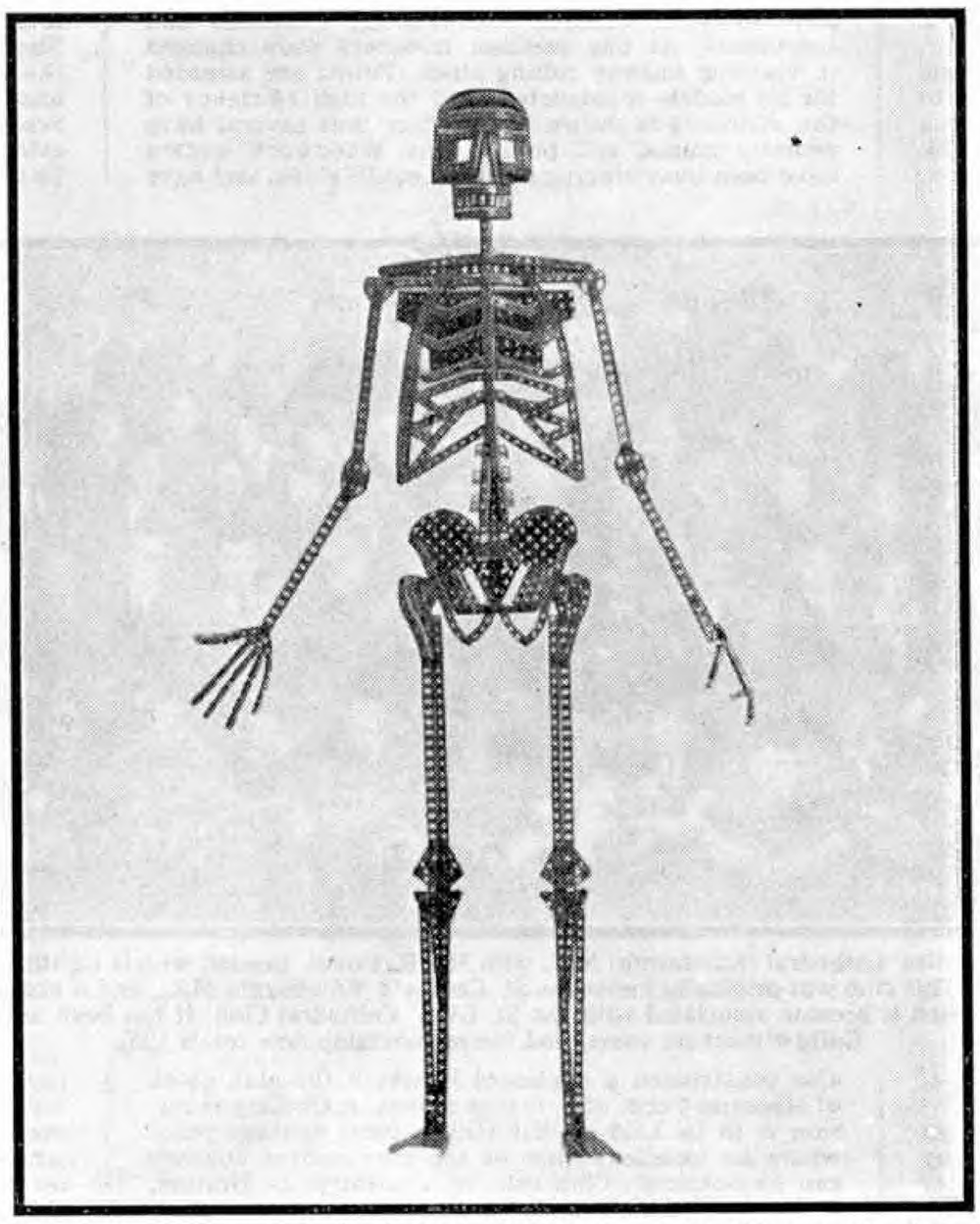
The model built by L. Rhodes, who won Second Prize in Section B, also is simply constructed. It is a traction engine, the boiler of which is made of two Meccano Boilers bolted end to end. The gear-box and bunker are made from 5½" × 2½" Flat Plates bolted to one end of the boiler, and the cylinder is a Sleeve Piece fixed between two ¾" Flanged Wheels, in the bosses of which a short Rod slides. This Rod is fitted with a crosshead and is coupled to a Crank Shaft, which carries a 3" Wheel for a flywheel. Similar Wheels are used also for the front steering wheels of the engine, and the large driving wheels are made from Circular Girders fitted with 2½" Strips for spokes and Bush Wheels for hubs.

K. M. Hill, the winner of the Third Prize in this Section, is to be congratulated on an excellent piece of work. His model represents a street organ-grinder and his pet monkey. The organ is built on a base made from a 5½" × 2½" Flat Plate, through which a 3½" Axle Rod is pushed and then fitted with two 3" Pulleys. The organ itself is made from 5½", 2½" and 2" Strips, and although it is rather crudely finished it looks quite realistic. The organ-grinder is made from Strips, and the monkey from ½" Reversed Angle Brackets and ½" × ½" Angle Brackets. Its head is a ½" loose Pulley, to which is fixed a ½" Pinion for a hat.

There are no really outstanding models among the winners of the smaller prizes, the best of these being those sent by W. Stiling and H. Beckett, both of whom are members of the Exeter Meccano Club. Stiling's model represents a gasometer at the local gasworks. It is octagonal in shape with uprights made from 18½" Angle Girders braced by means of 12½" Strips and 5½" Braced Girders. The gas container is constructed from 12½" Strip Plates bolted to a framework of Angle Girders and Strips.

H. Beckett's model was reproduced from photographs of a special omnibus that was designed for use on trackless desert country. The chassis is carried on six wheels and it hauls a long trailer that contains sleeping accommodation for a number of passengers.

In the Overseas Section there are many models that I should like to illustrate and describe in detail, but the space available for these notes permits only a brief mention of those most interesting to readers generally. Foremost among these models are a ship unloading machine and a Brownhoist coal-handling machine that were built by P. J. de Proft. The models are rather complicated, and it is impossible for me to give any useful constructional information concerning them in space of a few lines. Both of the models are original in subject, well built and neatly finished, and this I think, is the highest praise one can give to the work of this competitor.



**This remarkable model of a human skeleton is a splendid example of the adaptability of Meccano parts. It was built by J. Nie, Shanghai, for whom it won Third Prize in Section C of the "Winter" Competition.**

R. Myburgh, who is well known to readers of this page as the builder of many fine competition models, submitted for the present competition a model of the oil tank vessel "*British Grenadier*" that plies between Singapore and Capetown. The hull of the model is 1½" high amidships and 3" at the bow and stern. The fore deck is complete with winches and a life-boat, and also with a support for an awning. The bridge amidships also is provided with similar supports, and the engine-room and galley in the stern have ventilators and stanchions as in an actual vessel of this type. Realism is given by the addition of Dinky Toys figures.

The skeleton illustrated on this page is the work of J. Nie. Although the model is far from correct anatomically it illustrates the adaptability of Meccano parts and the good effect that ingenious use of them can produce.

## "Fun with Dinky Toys" Competition

On the Editorial page of the December 1935 "*M.M.*" the Editor offered a number of prizes for the best suggestions for tabletop fun with Dinky Toys. Among the many suggestions received are several original and interesting ideas, and I intend to refer to some of these in the "*M.M.*" The prizes were awarded as follows:

1st Prize, Cheque for £1/1/–: C. C. Forsyth, Bellville C.P., S.Africa. 2nd, Cheque for 15/–: Douglas Murison, Buenos Aires. 3rd, Cheque for 10/6: J. Halsall, Southport.




**Sutton Valence Council School M.C.**—Several Model-building Competitions have been held and all have been greatly enjoyed. In one Contest a special feature was made of working models, and those completed included a roundabout; trip hammer; lorry with brakes and gearing, and a hammerhead crane. Another model of a crane was equipped with two motors, one for lifting the load and the other for moving the crane. This fine display was inspected by the President, who also gave a short lecture on "*One-Piece Metal Work*" and exhibited some of the objects he had made from metal. The members were interested to learn that he had even invented the machines he used in this work. The future programme is being planned according to members' suggestions, and is expected to include, as last year, a Sports Meeting between the club and the school; Visits to local places of interest, and outdoor meetings during which model aeroplanes will be flown. Club roll: 25. *Secretary:* J. Chandler, "Herriard," Chart Sutton, Nr. Maidstone, Kent.

**St. Thomas (Exeter) M.C.**—Meetings have been held at the Leader's house, and most of them have been devoted to model-building. During the latter part of each meeting an instalment of a serial story is read. New members have to sign their names on the club Roll of Honour, which is framed and hangs on the club-room wall. Club roll: 24. *Secretary:* L. Robinson, 15, Brunswick Street, St. Thomas, Exeter.

**Bexleyheath Boys' Central School M.C.**—At one meeting a member brought along a clockwork railway he had built. It consisted of a spiral track that started at ground level and was carried upwards on Meccano supports to a height of 1 ft. above the ground. A novel feature of the railway was an automatic lift to lower the engine to the ground when it reached the top of the track. Another member has constructed a model workshop, driven by a small mains electric motor. Extensive preparations have been made for the School Open Day. Club roll: 30. *Secretary:* D. Hicks, 4, Audrey Avenue, Long Lane, Bexleyheath, Kent.

**Kidderminster M.C.**—An illustrated lecture on "*Chenille Carpet Manufacture*" was given recently by Mr. C. P. Harris, the Chairman of the Kidderminster H.R.C. Branch, and was much enjoyed. Club roll: 12. *Secretary:* E. J. Watkins, "Elmar," Wolverhampton Road, Kidderminster.

**Claremont Avenue School M.C.**—The biggest event recently has been the club Exhibition, which attracted many visitors. The models included a motor chassis; bascule bridge; derricking crane; aeroplane and a striking Dinky Toy display. The visitors were also very interested in a display of model aeroplanes made of wood and balsa. Club roll: 13. *Secretary:* G. Furton, 5, Brookfield Crescent, Kenton, Harrow.

**Plymouth M.C.**—The club magazine "*The Gearbox*," has been divided into three parts, headed respectively "*Railway News*," "*Municipal Transport Notes*" and "*Shipping News*." Each part is under the direction of its own sub-editor. The first issue in which these three sections were featured also included a competition, and proved very popular. The Hornby section of the club have not laid down a permanent track, as they prefer to adopt a new layout frequently; and each new one seems better than its predecessor. The club provides only the track, and members bring their own locomotives, about six being available at most meetings. Club roll: 70. *Secretary:* R. G. Symons, 47, Lisson Grove, Mutley, Plymouth.

**Barnard Castle School M.C.**—This recently-affiliated club is doing well. The members are very enthusiastic, and many new ones are being enrolled. The club has been divided into two groups, one devoted to Meccano activities and the other to Hornby Train operations, and it is probable that a Cycling group will also be formed. Club roll: 15. *Secretary:* S. L. Wears, The School, Barnard Castle.

**Enfield Grammar School M.C.**—The Meccano section has completed a fine model of an overhead railway of the George Bennie Railplane type, and it is being used to supplement the club layout. This layout is now complete except for lineside accessories, and the Railway section are busily engaged in making them. A new section has been formed to deal with wireless for the club room. An interesting talk on "*Scale Model Wagons*" was given by Mr. Hemingway, a prominent member of the Model Railway Club, during a recent visit. He illustrated various points in his talk by partly building a scale model wagon. Club roll: 35. *Secretary:* J. H. Pettifer, 31, Goat Lane, Forty Hill, Enfield.

**St. Stephens (Saltash) M.C.**—Models recently constructed have included roundabouts, windmills and aeroplanes. At one meeting members were engaged in building railway rolling stock. Points are awarded for all models constructed, and the high efficiency of the members is shown by the fact that several have recently gained full points. The Woodwork section have been busy making a fleet of model ships, and have also constructed a cupboard in which the club stock of Meccano parts, etc., is now stored. A Cycling excursion is to be held to Kit Hill, a local vantage point where an excellent view of the surrounding country can be obtained. Club roll: 16. *Secretary:* B. Braund, 9, Homer Park, Saltash.



**Members of St. Giles' Cathedral (Edinburgh) M.C. with Mr. R. Croall, Leader, who is eighth from the left on the second row. This club was originally known as St. George's (Edinburgh) M.C., and it acquired its present name in 1934 when it became associated with the St. Giles' Cathedral Club. It has been affiliated with the Guild almost six years, and the membership now totals 185.**

**Wednesbury and District M.C.**—This recently re-organised club continues to make good progress, and both the Meccano and the Fretwork sections are doing well under the guidance of their capable leaders. The Master of the local High School has accepted the Presidency of the club, and he is taking an active interest in the members. Cycling, Cricket and Model Aeroplane Sections are being formed to provide scope for outdoor activities during the summer. A Lantern Lecture on "*British Locomotives*" has been given by J. Lemaire, a member, and the secretary recently gave an interesting talk on "*Fretwork*." A Social and Games Evening during which various party games were played was greatly enjoyed by all present. Club roll: 28. *Secretary:* A. L. Morgan, 17, Cobden Street, Fallings Heath, Wednesbury.

**St. James (Grimsby) M.C.**—Model-building was the chief occupation during the second Winter session. At one meeting the members working in pairs began the construction of three large models. One pair decided to build a large travelling gantry crane driven by a steam engine; another a swivelling jib crane complete with luffing movement; and the third pair began a model of the quayside ship unloader illustrated in the February "*M.M.*" The ship unloader was driven by a clockwork motor in place of the electric one in the "*M.M.*," and the gear-box had to be specially adapted. The completion of these models kept the members busy for several evenings. Club roll: 6. *Secretary:* A. N. Dixon, 65, Yarborough Road, Grimsby.

**Stationers' School M.C.**—Outdoor activities have chiefly centred round the construction of a portable railway layout. The Model Railway section have been attending to the track and rolling stock, the Electrical section are responsible for the colour light signalling and controls, and the Meccano and General Engineering section have been busy building the bridges, stations and model village. Members enjoyed a Lantern Lecture on "*The Story of London's Underground*," in connection with which London Passenger Transport Board kindly supplied booklets describing the construction of the Underground railways. A Lecture has also been given on "*Track Circuiting and Automatic Signalling.*" Outings have included Visits to the Science Museum, South Kensington, where the Curator had kindly arranged a special demonstration of the automatic telephone equipment, and to the L.N.E.R. Works at Stratford, the most popular department of which was the machine room. The secretary is compiling a history of the club, and this will be printed in the School magazine. The meetings have been well attended, and the membership has increased recently by almost 75 per cent. Club roll: 25. *Secretary:* R. J. Post, 8, Bourne Road, Crouch End, London, N. 8.

## AUSTRALIA

**Maylands (Perth) M.C.**—The first Anniversary Exhibition was a great success, and the excellent display of models was much praised. The Meccanograph and a penny-in-the-slot machine were especially popular, and collected a total of 16/–. A Party was held after the Exhibition, and a few nights later a Parents' Social was held, both events proving most enjoyable. On Easter Monday a visit was paid to the Midland Junction Railway workshops, where the members were greatly interested in all they saw. Club roll: 22. *Secretary:* M. Thomson, 13, Kennedy Street, Maylands, Perth.

## NEW ZEALAND

**Christchurch M.C.**—The membership is increasing rapidly and all are keen model-builders. Recent accomplishments have included some fine models of cranes. Another visit has been paid to the invalid boy mentioned in earlier reports, and he was again very thrilled by the working models that some of the members took with them and demonstrated. A delightful day in the open air was spent recently when the club tramped over the Cashmere Hills to Lyttleton Harbour and thence to Governor's Bay at the head of the harbour. Most of the members took their fishing tackle with them, and after having tea and feeding the seagulls they enjoyed some very successful angling from a little pier that juts out into the Bay. A walk home in the twilight concluded this ideal outing. Club roll: 24. *Secretary:* L. W. Best, 28, Circuit Street, Strowan, Christchurch.

## SOUTH AFRICA

**Pioneer (Pietermaritzburg) M.C.**—The club has become officially associated with the Maritzburg Amateur Horticultural Society. This gives the club the privilege of staging displays of models at the two exhibitions held each year by the Society, and it is hoped that the publicity thus obtained will be the means of attracting many new members to the club. Club roll: 11. *Secretary:* A. H. Alley, 461, Burgers Street, Pietermaritzburg, Natal.

**Malvern M.C.**—Indoor meetings have been divided between Talks and Model-building. Models completed have included representations of many unusual subjects, such as a baboon, a street fiddler, a nurse and pram, a compass and a lighthouse. A most enjoyable visit has been paid to the Witwatersrand Technical College, where Professor Willowes-Munro gave a Talk on "*Mining*," during which the members learned many interesting facts about this great Witwatersrand industry. Afterwards they were conducted through the laboratories, where they saw many interesting scientific instruments in action. Outdoor activities have included a cross-country run over a course of about three miles. Club roll: 85. *Secretary:* B. H. Saunders, P.O. Box 8, Cleveland, Johannesburg.




## Model Aeroplane Meetings

In reading the club reports during the first summer session I have been interested to note that several clubs are including model aeroplane meetings among their outdoor activities. This is not surprising, as interest in aeroplanes and air services is greater to-day than ever before.

The construction of model aeroplanes is an ideal hobby for the summer months, and can readily be carried on as a club affair. Models of varying degrees of complexity and difficulty can be made, ranging from simple machines of thin card to more elaborate aeroplanes with longerons and spars of wood strip, and plane covering of suitable fabric.

A further good point about the hobby is that it is especially suitable for competitions, as summer is the best time of the year in which to make the practical tests of flying ability that must be the chief consideration in awarding prizes. Ordinary open competitions may be run, in which competitors are asked to enter aeroplanes designed and constructed by themselves from any material, but others in which the materials to be used are restricted in character, or an aeroplane of a particular design is to be made, will provide great scope for ingenuity.

In deciding on the merits of the entries in any competition, marks should be awarded for good workmanship and ingenious methods of construction, while if the competition is an open one the merits of the design must be taken into account. First consideration must be given to airworthiness, however. An open space free from accidental air currents is required in order to carry out tests of this, and if possible aeroplane meetings should be held in conjunction with country excursions. In addition it will almost certainly be found that the proceedings will be lengthy, as the members are sure to be so interested in the winning models that they will want to see them in operation repeatedly, and ample time should therefore be allowed. Each entrant should be permitted three trials in which to demonstrate the stability and range of his machine in the air.

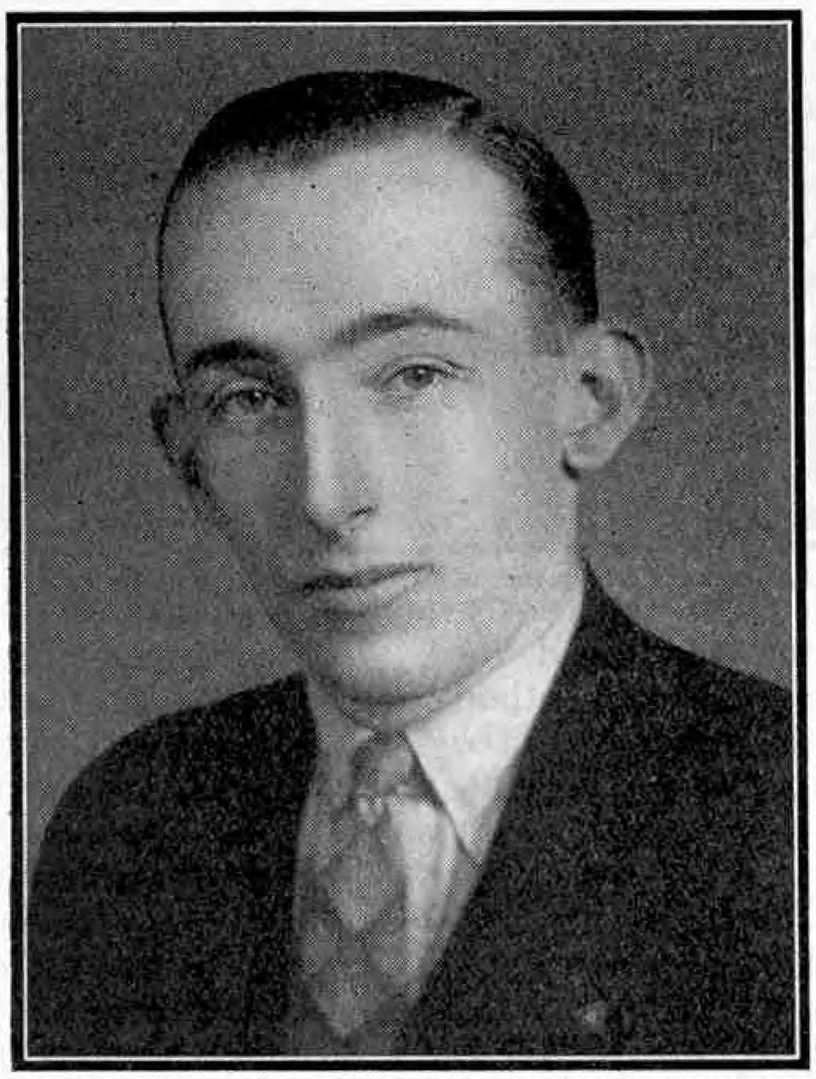
## Summer Holiday Hints

One of the habits that engineers, whether amateur or professional, should cultivate is that of observing keenly and storing in mind information gained in this manner, of which good use may be made later. There are always opportunities for training of this kind, but perhaps the best of all come with the summer holidays, when most boys leave for a short time the surroundings with which they are so familiar, and find themselves in places where on all sides there is something new to be observed.

I should like every club member to keep a keen lookout during his summer holiday for something of interest that is new to him. By doing so he will form a basis for good model-building next winter, and the little time and trouble involved will then be fully repaid. In addition to this a holiday frequently affords ideas for other features of the programme, such as new lectures and papers, additions that will make Hornby train operation more realistic, and other hobbies and pursuits to increase the variety and interest of club work. There is nothing like variety to maintain interest in club affairs, and no opportunity of seeking means of increasing the enthusiasm of members and adding to the attractiveness of the programme should be overlooked.

## Meccano Club Leaders

### No. 83. Mr. W. J. T. Watson



**Mr. W. J. T. Watson was the founder of the Sydney (Australia) M.C., of which he has been Leader since 1933. The club programmes are very attractive and include Model-building, Games, Lectures, Debates, Social Evenings, and Visits to places of interest.**

## Encouraging Club Photography

In practically every club there are members who own cameras, and the various summer excursions and outdoor meetings provide plenty of scope for them to practice their hobby. These members should be encouraged to learn how to make the best use of their cameras, and it is a very good plan to form a photographic section and give talks and demonstrations designed to help the beginners to get the best out of the hobby. These talks should be of a practical character, of course, and not merely lectures describing what happens when a photographic plate is exposed; and the senior members of the club will no doubt be able to help in this work.

Small prizes may be offered for the best collection of photographs taken during the summer sessions, for this develops a spirit of friendly rivalry among the photographers, and encourages them to take the necessary steps to secure good results. An important consideration is that an attractive record of the various activities of the club during the summer months can be obtained in this manner. I hope that this course will be followed in many clubs during this session, and while on the subject I wish to remind Leaders and secretaries that I am always pleased to see photographs showing their members at work or play, and if they are suitable, to make use of them in these pages. I should like to mention also that in most cases I can obtain a much stronger and clearer reproduction from the negative than from a print, and whenever possible the negative should be sent.

## Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:

GUIST, S.O.—N. L. Everitt, High Street, Foulsham.
INDIA—R. K. Banerji, D40/5 Lachmanpura, Benares City, U.P.
MALTA—A. Cappola, 96, St. Vincent Street, Sliema.
NEW ZEALAND—C. C. Carncross, Graham Street, Eltham, Taranaki.
NEW ZEALAND—V. Hack, Pleasant Road, Glen Eden, Auckland.

# Hornby Tank Wagons and their Uses

## Miniature "Liquids in Bulk" Transport

THE distinctive nature and appearance of Hornby Tank Wagons make them of special interest to the miniature railway owner. Real tank wagons have been familiar objects on our railways for many years and are now being employed in increasing variety for the transport of liquids in bulk. Similarly the miniature Tank Wagons of the Hornby Series have grown in numbers, and this article deals with the variety of types available and the services on which they can be used.

One of the most attractive vehicles of this kind is the Milk Tank Wagon, which represents in miniature one of the most recent applications of the tank wagon for the bulk transport of liquids. Fleets of such tanks are now operated by various dairy organisations, and they run on each of the four group railways, bringing supplies from the concentration points in dairy farming areas to the town depots from which distribution is carried out. For large consignments passing regularly by rail the tank wagon indeed has almost entirely supplanted the familiar churn, but the latter is still employed for smaller quantities. The advantages of the new method are strikingly realised when it is remembered that the churns chiefly in use have capacities of 10 to 17 gallons, while tank wagons hold as much as 3,000 gallons or even more.




**Milk traffic is an important feature on the layout of Mr. H. G. Ogden of Victoria, B.C., part of which is shown in this photograph. A Hornby Milk Tank Wagon is prominent in the siding in the foreground.**

The Hornby Milk Tank Wagon consists of a large cylindrical tank supported on two bolsters mounted on a standard wagon base. As in real tank wagons, there is a beam at the top of two vertical pillars across each end of the tank and wire braces run diagonally from the beams down to a point near the centre of the solebars of the vehicle. These arrangements serve to retain the tank in position.

The miniature tank itself is complete with the usual manhole on top, and there are also representations of the inlet valve for filling and the safety outlet that are fitted to the real tanks. The details are completed by the fitting of the inspection ladder, which passes over the tank about the middle. The tank is painted white, in accordance with the usual practice for insulated vehicles or containers that have to be kept cool.

Milk Tank Wagons can be used in the formation of trains consisting entirely of such wagons, or of others that also include Milk Vans. Special milk trains of both kinds are run regularly in real practice and should therefore be included in the working timetables of any miniature railway system that makes a feature of perishable traffic of this type. Where a single Milk Tank Wagon is the only representative of its kind on the line, it can be attached to a convenient passenger train in order to work it up to the town depot. Real tank wagons are fitted with brake pipes and steam heating connections to allow of their inclusion in passenger train formations, so that the use in this way of a miniature Tank on a Hornby Railway system will be quite correct. In the operation of milk trains it is important that any shunting or other movements involved in attaching and detaching vehicles should be carried out with care, or the cargo may be spoiled. Similar precautions in miniature practice will add to the interest, so the injunction *"shunt with care"* should be obeyed literally by the "staff."

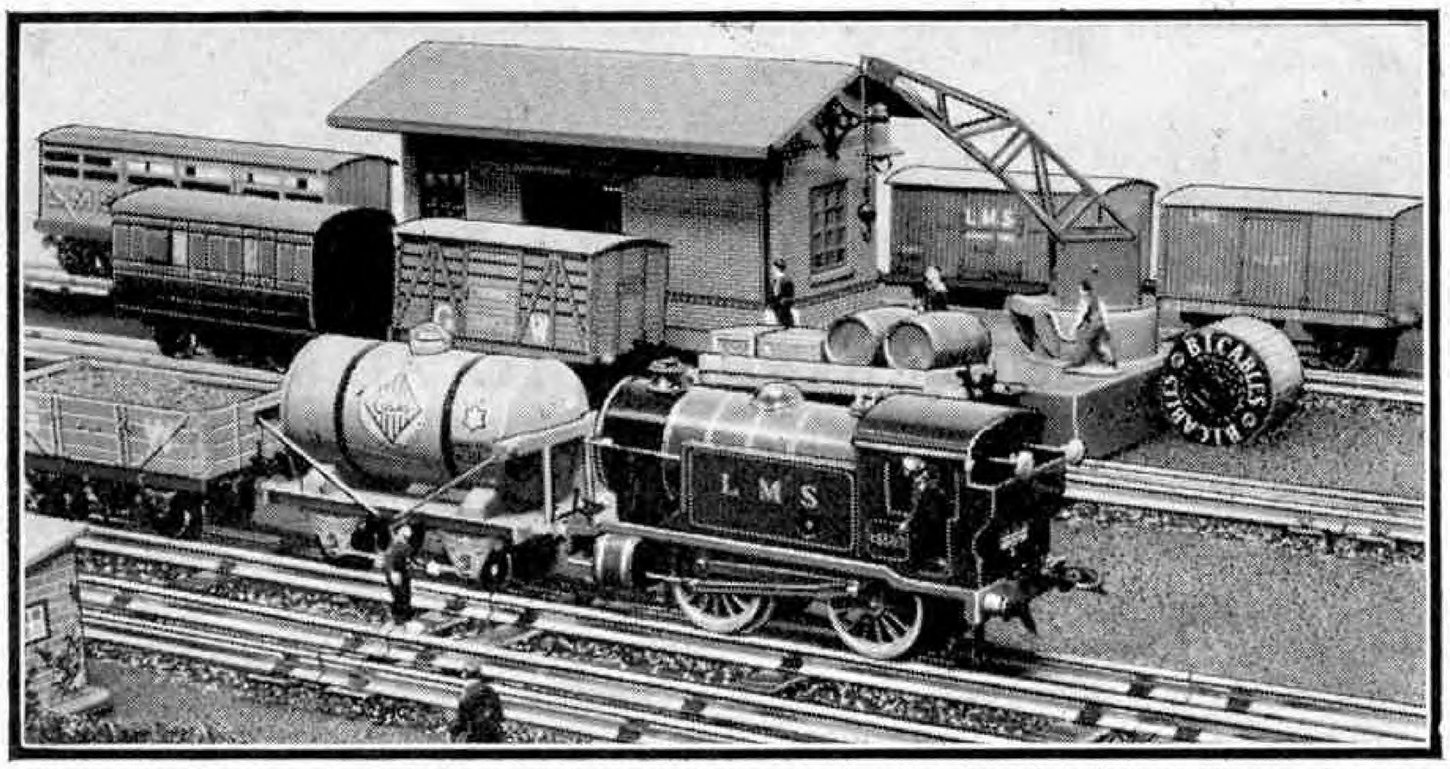
Efficient loading and unloading arrangements are essential to the success of milk tank wagon operation. If possible the lineside accessories of a miniature railway in which use is made of Hornby Milk Tank Wagons therefore should include buildings in which they can be accommodated at each end of the journey. The real rail tanks are fed from storage tanks by means of pipe line connections and similar means are employed for emptying them. These can scarcely be reproduced in miniature, but the provision of a building supposedly housing the pipe connections gets over the difficulty.

An interesting point in connection with milk tank traffic is the road collection of the churns from the farms for delivery to the depots where the tanks are filled, and the return of the necessary "empties." To assist in this process small loading platforms are erected at the roadside in dairy farming districts at points convenient for the farmers. The full churns are placed on these platforms for collection by lorry, and the empty ones similarly are returned there. On layouts where special attention is given to lineside effects and road services, such platforms would be an interesting and unusual roadside feature.

The lorry service could be efficiently performed by suitable vehicles of the Meccano Dinky Toys Series. The motor Wagon, Dinky Toy No. 25A, included in the Set of Commercial Vehicles No. 25 could be used, or the Flat Truck No. 25C. The Market Gardener's Van, No. 25F, with its open post-and-rail sides is typical of the motor vehicles frequently found in farming districts. The Trailer

No. 25G could be run behind any of these for loads heavier than usual.

The "Colas" Bitumen Tank Wagon is of similar construction to the Hornby Milk Tank Wagon, but is intended for a load of a very different character. This is the representative in the Hornby Series of the numerous wagons used in practice for the conveyance of tar and similar substances. The tank wagon operated by Colas Products Ltd. carries a special material used for the surfacing of drives and paths. The "Colas" Bitumen Tank Wagon forms an interesting addition to a mixed freight train in miniature, and can be worked to any station serving an area where "building developments" are supposed to be in progress. Tar and similar heavy liquids are sometimes carried in wagons having rectangular tanks. Modern practice favours the use of cylindrical tanks, however, and this is the type of tank wagon used exclusively in the Hornby Series.

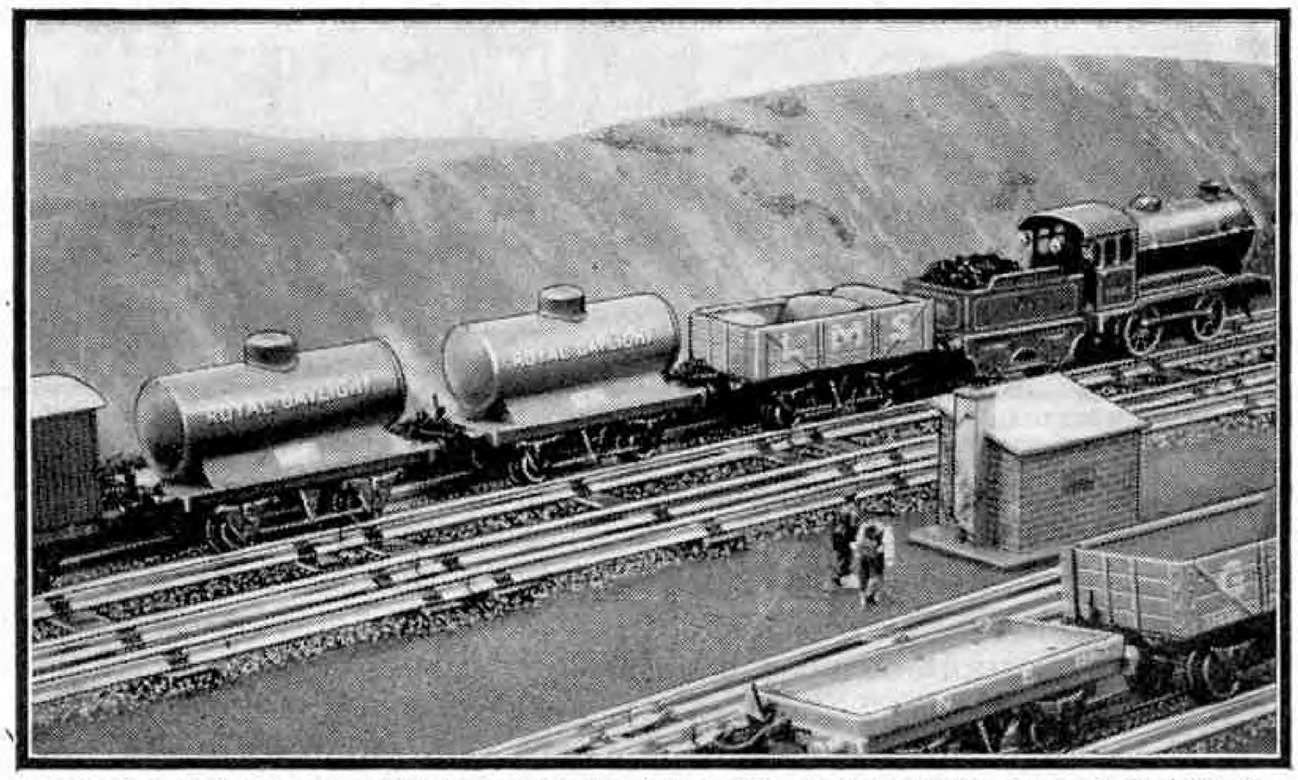



**Shunting in a local goods yard. The vehicle next to the engine is a Hornby "Colas" Tank Wagon of the type referred to in this article.**

Simpler features of design and construction are embodied in the remaining Tank Wagons of the Hornby Series. These include the No. 1 Petrol Tank Wagons and the similar Oil Tank Wagons. In these the tank is mounted on a "saddle" or support that is fitted to the standard wagon base. Although the No. 1 Tank Wagons are less detailed than the larger Milk and "Colas" vehicles, they have a realistic appearance; each tank is provided with the characteristic manhole in the centre on top and is decorated in the style of the particular petrol or oil company that is represented.

The range of Tank Wagons is completed by the MO Petrol Tank Wagon "Shell-Mex." This neat little vehicle, which was dealt with in detail in the *"M.M."* last December, conforms to the usual MO standards in size, wheelbase and coupling arrangements, and the tank is attractively finished in the style adopted for "Shell-Mex" rolling stock. Various realistic details are incorporated, among them a warning of the dangerous nature of the contents in the words: *"No lights to be brought near this tank."*

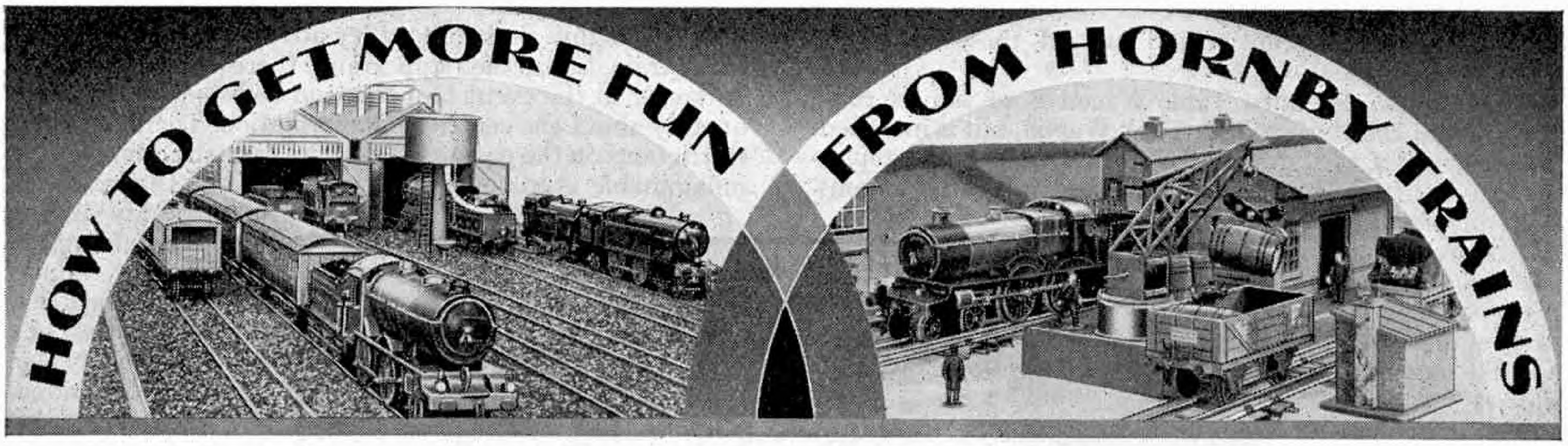
The working of tank wagons containing petrol and any other inflammable liquids is subject to special regulations in actual practice. A great deal of fun can be obtained if special rules are applied in miniature, and if necessary, certain restrictions could be imposed to suit special conditions on the lines of individual Hornby Railway owners. Petrol tank wagons in a freight train are usually marshalled away from the engine. Sometimes they are placed at the tail end of the train, but as their appearance there might be a source of danger in the event of a rear-end collision they are frequently about the centre of the formation. There are often restrictions on the passage of vehicles carrying dangerous or inflammable goods over sections of the line that traverse important bridges or bore through lengthy tunnels. In miniature the passage of a Hornby Viaduct or a big Meccano bridge might be forbidden; or the dangerous traffic might be restricted to certain times in order to avoid periods of "traffic pressure."




**A mixed freight train on a Hornby layout. The "Royal Daylight" vehicles are typical of the construction of Hornby Oil Tank Wagons, and form one of the latest additions to the range.**

As in the case of the Milk Tank Wagon, the use of Petrol and Oil Tank Wagons is made more realistic if suitable lineside accessories can be arranged in connection with their traffic. Thus the addition of buildings representing refineries with their circular storage tanks, the whole plant served by sidings, would add considerably to the effect of the operation of miniature tank wagons over a Hornby Railway system. Shunting in the neighbourhood of such premises is invariably carried out by special fireless locomotives. These look much the same as the usual type of works shunting tanks except that they have no chimneys! An old Hornby Tank Locomotive minus this fitting could thus represent a fireless engine reasonably well, although strictly the bunker and side tanks also are unnecessary.

The remaining wagon of the Hornby Series that comes within the tank class is the Gas Cylinder Wagon, which represents the real vehicles used for the conveyance of oil gas. This gas is still used for lighting railway coaches and is extensively employed on dining cars for cooking purposes. It is carried under pressure in gas cylinders attached to the underframes on the vehicles. At points where the "gassing" of trains is regularly carried out storage tanks are let into the ground, and outlets at suitable spots make it possible for the gas cylinders on the coaches to be replenished by means of armoured hosepipes. These storage tanks are kept supplied by the conveyance of gas to them in gas cylinder wagons that are run between the producing plant and the gas filling stations. Such a wagon usually consists of two or three strong cylinders mounted on a standard underframe. The Hornby Gas Cylinder Wagon has three dummy cylinders and is an attractive and unusual piece of rolling stock. It can be run in passenger or goods trains as required, and it can be left at times at a terminal or junction station.




## RUNNING SUBURBAN AND LOCAL SERVICES

SUBURBAN and local services that connect country districts and residential areas with cities and towns are of great importance in railway working, and there are many specially interesting features in their operation. In this article it is proposed to deal with useful points in connection with them that will be helpful to those who wish to run services of this kind on their miniature railways.

On Hornby Railways the type of locomotive and rolling stock equipment required for "local" trains will not vary much, whatever the particular group favoured by the individual owner, although certain practices may be peculiar to certain groups, or even to certain sections. Tank engines can invariably be employed, and then less platform length is necessary and turntables are not really required although they are useful in certain circumstances. More effective use therefore can be made of a restricted space. Advantage can be taken of the frequent station stops on clockwork railways for winding the engine, and with an appropriately organised service a great deal of fun can be obtained.



An "auto train" on a miniature G.W.R. system. This is composed of a No. 1 Tank Locomotive and a No. 2 Pullman Coach, the latter representing the centre-gangway type of car frequently employed on such duties.

For trains operating on the most important business or residential services on a Hornby Railway the No. 2 Coaches are ideal. The arrangement of the compartments is such that a complete train of these vehicles contains plenty of third-class accommodation; at the same time the first-class traveller—an important person on such trains—is by no means neglected. The first-third No. 2 Coaches contain first-class and third-class compartments in equal numbers, so that a three-coach train consisting of one first-third and two brake thirds ensures satisfactory accommodation for all. The brake thirds have a guard's compartment and just enough luggage accommodation. The guard's lookouts are placed at one end of the vehicle and give a typically "suburban" appearance to the formation.

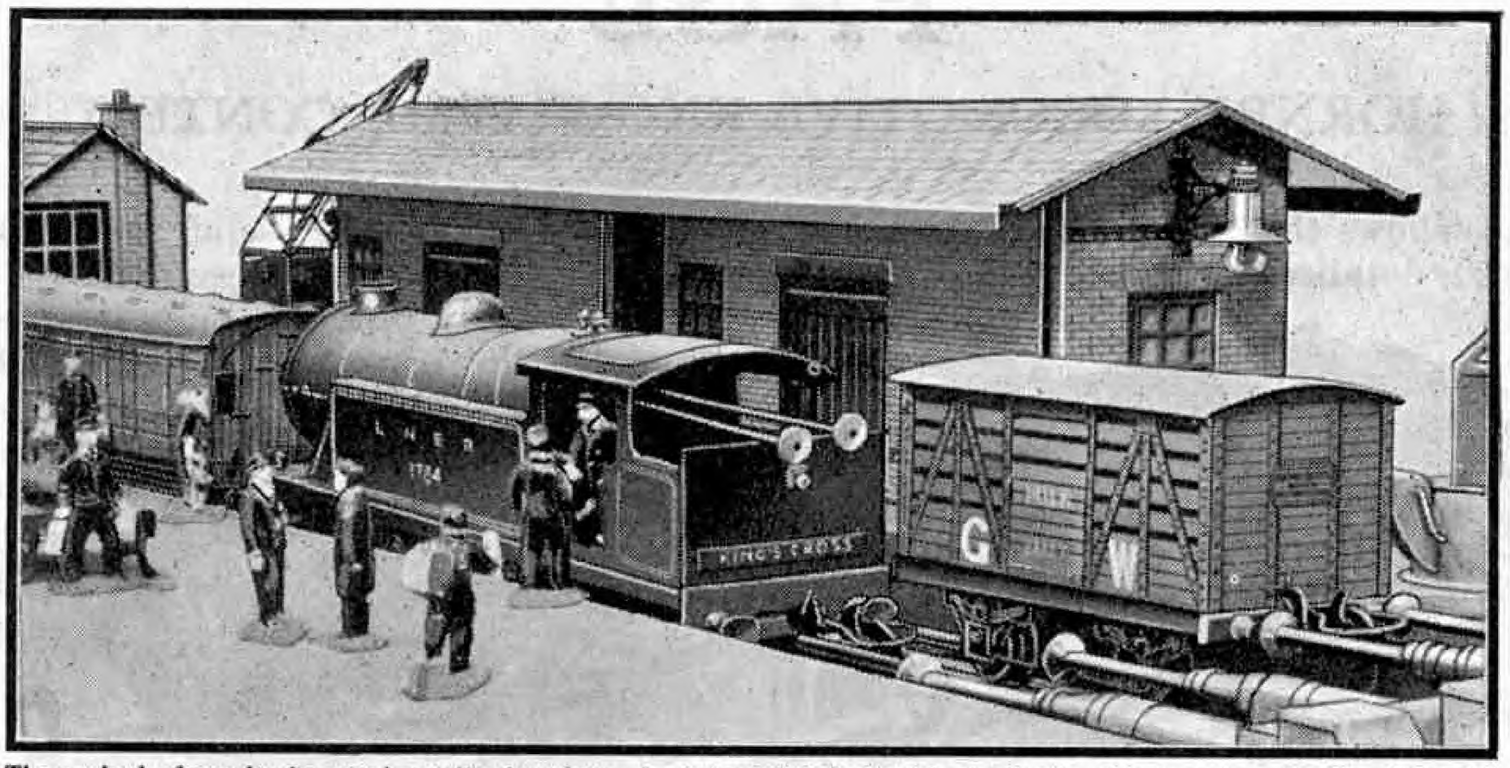
The best engine for the more important suburban trains is the Hornby No. 2 Tank or, on electrically-operated lines, the E220 or E26 Special Tank. These three engines are of the same external appearance, and they represent the large passenger tanks in use on British railways. The clockwork No. 2 Special Tank is a powerful engine and has a very satisfactory length of run. A lively dash from station to station by one of these engines, with two or three No. 2 Coaches, will reproduce quite well the energetic running that is characteristic of most business trains. On electrically-operated railways much more realistic running is possible owing to the greater degree of control. The automatic reversing gear of the E220 Special Tank Locomotive also is of great advantage in the operation of suburban services. Apart from uncoupling the engine at each end of the trip no further handling of the train is necessary, as the Locomotive is reversed from the lineside by means of the speed regulator handle on the Transformer. Coupling up of course also is automatic when the vehicles are pushed together.

With regard to the actual services represented, much depends on the Hornby Railway owner and his personal preferences. Hornby No. 2 Tanks and No. 2 Coaches are suitable for the reproduction of the suburban services worked in and out of the London termini. Some of these services are more of a long-distance or "outer" suburban character, either because of the situation of the line, such as the G.W.R., or as the result of the electrification of the inner suburban area, as on the L.M.S.R. Euston services. Services centred on such places as Birmingham, Manchester and elsewhere where local traffic is heavy also can be reproduced.

On layouts where space is restricted it may be necessary to employ only four-wheeled locomotives and coaches. Suburban trains are readily made up of Hornby No. 1 Coaches and Guard's Vans. At times when the pressure of traffic increases it is quite easy to add one or two units to normal formations, and it is just as easy to detach them

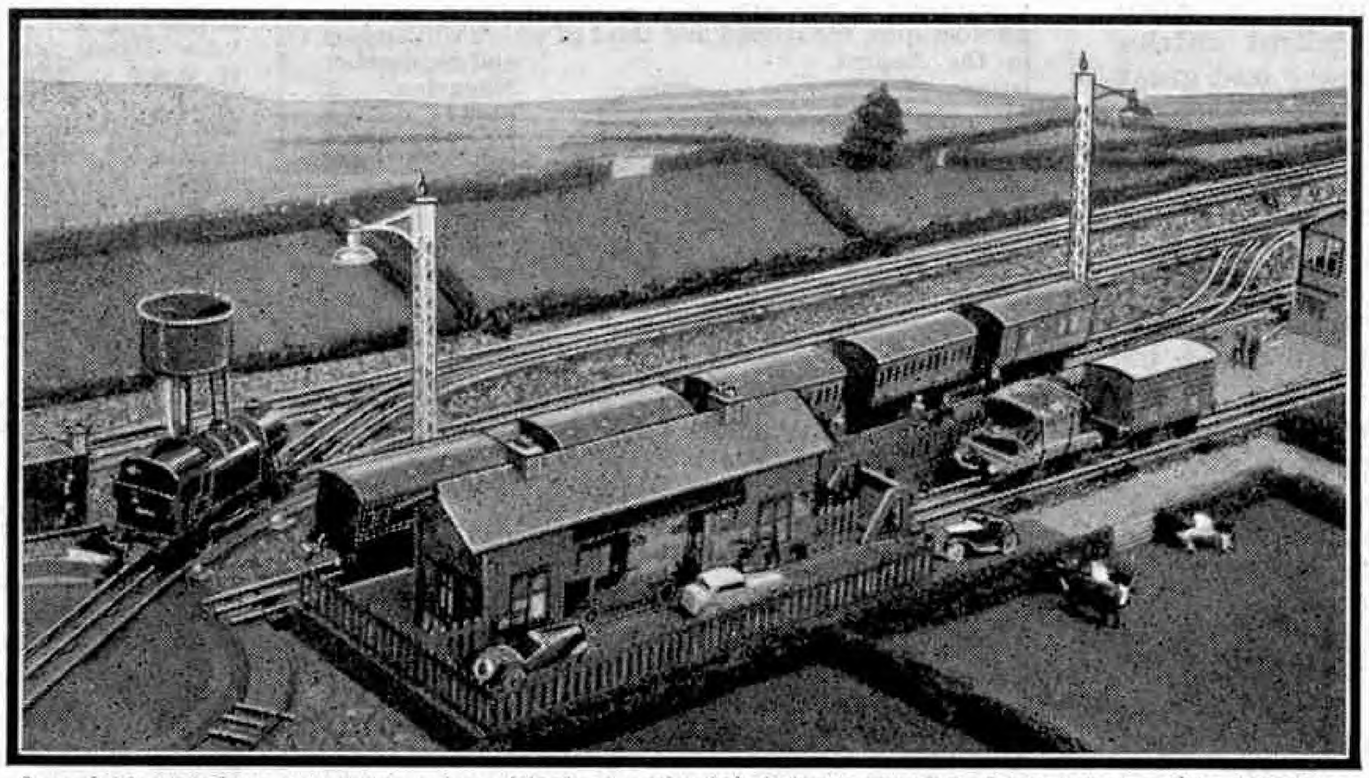
at slack periods. For regular working of the suburban services each standard formation or set train should be arranged with a Guard's Van at each end if possible. On some Hornby Railway layouts the owners have standardised four-wheelers for suburban traffic owing to their extreme handiness, although larger vehicles and locomotives may be in use for main line work.

It is frequently the practice to attach to the longer - distance suburban trains a van for any traffic, such as parcels, milk, or fruit in the season, that is to be worked into the towns or cities served. The addition of such a vehicle to a Hornby local train will add to the interest of its operation and a Milk Van, or other Van according to the traffic, can be employed in this way. A Hornby No. 1 Guard's Van also is very useful to represent many of the various types of vans that are used to convey parcels, milk in churns, and similar freights. In addition to its use in this way the No. 1 Guard's Van also can provide guard's and luggage accommodation on a train of No. 2 vehicles, if a bogie No. 2 brake-third is not considered necessary.



The arrival of a suburban train at the terminus. An interesting feature is the destination board on the No. 2 Special Tank Locomotive arranged as suggested in this article.

Owing to the complexity of routes and services in certain suburban areas various indications are carried on the engines of the trains in order that they may be readily identified. These indications may take the form of special route discs in place of the usual unlighted lamps by day, although lamps are of course necessary by night. Thus on the G.E. section of the L.N.E.R. both purple and white route discs are used on suburban trains in daytime, with corresponding purple and white lights at night, their arrangement varying according to the route served. Miniature discs can be made of circles of card, plain white or painted as required, and provided with a small "loop" of paper at the back to allow of their attachment to the lamp brackets on Hornby Locomotives.



A useful layout for a country terminus. The locomotive is being run round the branch train of No. 1 Coaches by means of a turntable and loop line.

Destination boards too are popular fittings on the locomotives of suburban trains. These are easily made of card and can be lettered according to the destination required on the miniature system. As the "stopping train" indication of the Standard Headlamp Code requires the use of the top lamp bracket only, the brackets above the buffer beam can be made to accommodate the destination board. If the board passes in front of the centre bracket and behind the two outside ones it will be held securely in place and will not be likely to be shaken off by the motion of the engine. Boards lettered on both sides are useful, needing only to be turned round to show a different destination. Care should be taken that the headlamp and the destination board are in the correct position for each trip.

The necessary changing of boards at each terminal point and similar minor operations add greatly to the fun of suburban train working.

Various types of rail-motor vehicles have been developed from time to time specially for branch line service. Each coach has its own motive power, either enclosed within or attached to the coach body in the form of a small locomotive. Apart from the L.N.E.R. on which modern self-contained steam coaches of rather different type from the older vehicles enjoy quite a vogue, more recent practice has favoured a return to the less specialised type of motor train operated on the "push and pull" principle. With these the engine pulls its load in the forward direction, but pushes it when travelling backwards, the driver then riding in the end compartment of what becomes the leading coach, and controlling the engine from there by means of special apparatus. The G.W.R. specialise in this form of operation and have built quite recently new engines specially intended for "auto train" working, as it is termed on that line.

Such a train in miniature forms an attractive unit on any layout and working on this system is becoming more and more popular with "*M.M.*" readers. A Hornby No. 1 or M3 Tank Locomotive can be made to perform "auto" duties in conjunction with a No. 2 Coach, either a first-third or a brake-third separately, or the two together if required. The centre-gangway type of coach often is employed for this work on real railways, so that a No. 2 Saloon Coach or No. 2 Pullman can be used, if preferred. With this form of working the running round of the engine at its destination for the return journey is not required; thus the terminal equipment of branch lines can be simplified.

Apart from their use on branch services such units are often employed to supplement the ordinary local and suburban services between certain points. In miniature, "auto trains" can quite well be run in a similar manner.

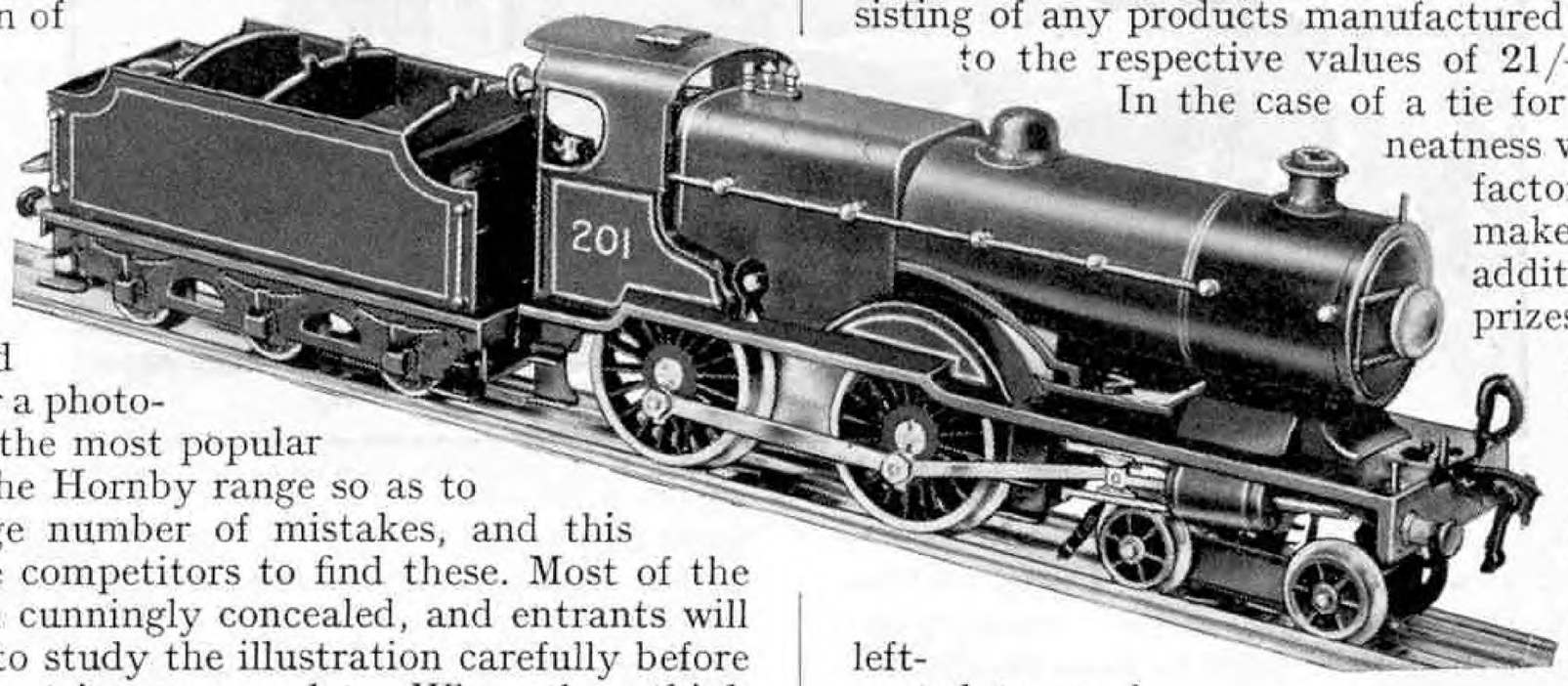
*Join the Hornby Railway Company and become eligible for the competitions announced on this page.*

# H.R.C. COMPETITION PAGE

## HORNBY LOCOMOTIVE KNOWLEDGE CONTEST

*Join the Hornby Railway Company and become eligible for the competitions announced on this page.*

Our correspondence shows that every H.R.C. member possesses a wide and detailed knowledge of Hornby locomotives, even of types of which he does not possess examples. In order to put this knowledge to an interesting test we asked our artist to alter a photograph of one of the most popular locomotives of the Hornby range so as to introduce a large number of mistakes, and this month we invite competitors to find these. Most of the errors have been cunningly concealed, and entrants will be well advised to study the illustration carefully before regarding their entries as complete. When they think they have discovered all the errors they should make a list of them, using one side of paper only, and forward this to the address given in the next column.




The Contest will be divided as usual into two sections, Home and Overseas, and to the senders of the three longest correct lists in each will be awarded prizes consisting of any products manufactured by Meccano Ltd., to the respective values of 21/–, 15/– and 10/6. In the case of a tie for any prize general neatness will be the deciding factor when the judges make the award. In addition to the main prizes a number of consolation prizes will be given.

Envelopes containing entries must be marked *"H. R. C. July Errors"* in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st July. Overseas closing date, 31st October. Competitors are reminded that their H.R.C. numbers must be clearly indicated.

## Railway Photographic Contest

Since announcing the first of the summer series of Photographic Contests in April we have received many excellent entries and each month the judges have had great difficulty in deciding which were the best. This month we expect even larger and better entries, for conditions at this time of the year usually are at their best for railway photography. As in previous contests, the subject is left to the competitor's own choice, and the only restriction is that the exposure must have been made by the competitor himself.

Competitors may send as many prints as they desire, but no competitor can win more than one prize in one contest. It is important that every print submitted should have on the back the name of the competitor, his H.R.C. membership number and his full postal address. A short description of the scene of the photograph also must be given. The best entries in these contests will be filed for possible publication in future issues of the *"M.M."*

The Contest will be divided as usual into two Sections, Home and Overseas, and to the winners in each will be awarded prizes consisting of Meccano or Hornby Train goods or photographic material if this is specially desired. The respective values of the three prizes awarded will be 21/–, 15/– and 10/6. A number of consolation prizes will be awarded in addition.

Envelopes containing entries must be marked *"H.R.C. July Photo"* in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st July. The Overseas closing date is 31st October.

## Summer Puzzle Contest

The strange-looking object shown here is actually a well-known product of Meccano Limited. The illustration is the first of a series of three mystery photographs, the second and third of which will appear in the August and September issues of the Magazine. A cash prize of £1/1/– will be awarded for the most complete solution of this three-fold puzzle.



There will be two sections in this contest, for Home and Overseas competitors respectively. As the last puzzle in the series will not appear until the September issue, the latest date for receiving solutions will be 30th September in the Home Section, and 31st December in the Overseas Section. Full directions for forwarding entries will be given in the September issue.

## Competition Solutions

### FEBRUARY "QUESTIONS" CONTEST No. 7.

The entries submitted in this contest were of a very high standard, Question No. 6 appears to have caused the greatest difficulty, and many competitors did not realise that Oxford was the station at which locomotives of all groups may be observed.

(1) Euston House, London. (2) 58.5 m.p.h. Paddington to Newport, G.W.R. (3) 14,000,000 tons. (4) 95 lb. (5) 2,112. (6) Oxford. (7) Diesel-electric express Berlin–Hanover 82.25 m.p.h. (8) Waterloo, London, covers 24½ acres. (9) Garston. (10) 60 ft. (11) G.W.R. (12) L.N.E.R. "Garratt" No. 2395.

### MARCH "NAME AND NUMBER" CONTEST No. 6

We publish below a complete list of the correct names and numbers so that competitors can compare the solution with their own efforts.

6170 *"British Legion"* (L.M.S.R.), 3442 *"Bullfinch"* (G.W.R.), 921 *"Shrewsbury"* (S.R.), 5581 *"Bihar and Orissa"* (L.M.S.R.), 917 *"Hurstpierpoint"* (S.R.), 2597 *"Gainsborough"* (L.N.E.R.), 5627 *"Sierra Leone"* (L.M.S.R.), 4698 *"Loch Rannoch"* (L.N.E.R.), 5941 *"Campion Hall"* (G.W.R.), 6141 *"Caledonian"* (L.M.S.R.), 863 *"Lord Rodney"* (S.R.), 4082 *"Windsor Castle"* (G.W.R.), 5718 *"Dreadnought"* (L.M.S.R.), 6021 *"Queen Mary"* (L.N.E.R.), 6850 *"Hatton Castle"* (L.N.E.R.), 3358 *"Tremayne"* (G.W.R.), 2758 *"Northumberland"* (L.N.E.R.), 742 *"Camelot"* (S.R.), 2834 *"Hinchingbrooke* (L.N.E.R.), 2426 *"St. Albans Head"* (S.R.), 5428 *"City of Liverpool"* (L.N.E.R.), 9661 *"Ole Bill"* (L.N.E.R.), 4475 *"Flying Fox"* (L.N.E.R.), 6026 *"King John"* (G.W.R.), 923 *"Bradfield"* (S.R.), 2041 *"Peveril Point"* (S.R.), 6108 *"Seaforth Highlander"* (L.M.S.R.), 5032 *"Usk Castle"* (G.W.R.), 792 *"Sir Hervis de Revel"* (S.R.), 5593 *"Kolhapur"* (L.M.S.R.), 2511 *"Silver King"* (L.N.E.R.), 5642 *"Boscawen"* (L.M.S.R.), 4934 *"Hindlip Hall"* (G.W.R.), 796 *"Sir Dodinas le Savage"* (S.R.), 6017 *"Breadalbane"* (L.M.S.R.), 9256 *"Glen Douglas"* (L.N.E.R.), 5429 *"Prince Henry"* (L.N.E.R.), 5637 *"Windward Islands"* (L.M.S.R.), 4068 *"Llanthony Abbey* (G.W.R.), 938 *"St. Olaves"* (S.R.).

## COMPETITION RESULTS

### HOME

**May "Locomotive Shadows Contest."**—First: C. E. Wrayford (6039), Moretonhampstead, Devon. Second: K. E. Milburn (26029), Chingford, London, E.4. Third: G. H. Gill (36093), Chorlton-cum-Hardy, Manchester. Consolation Prizes: J. E. Heydon (47755), Ambergate; M. L. Harper (8718), Wood Green, London, N.22; R. B. Hayter (21630), Bedford; J. L. Makin (30933), Penwortham, Preston.

**May "Railway Photo Contest."**—First: D. Bayes (25638), Walthamstow, London, E.17. Second: V. L. Breeze (2134), Lewes, Sussex. Third: C. Spencer (44179), Sheffield, 11. Consolation Prizes: J. W. Hague (1258), Ripon, Yorks.; R. B. Hayter (21630), Bedford; A. C. Clements (31981), Tunbridge Wells; W. K. Holme (45888), Holsworthy; F. Hodson (9430), Bolton, Lancs.

### OVERSEAS

**February "Concealed Stations Contest."**—First: H. R. Hondelink (25394), Oishi, Nada-Ku, Kobe, Japan. Second: W. G. Hallack (15578), Capetown, S. Africa. Third: D. J. White (9333), Christchurch, New Zealand. Fourth: I. Brough ((9112), Preston, Victoria, Australia. Consolation Prize: R. A. Wragg (7913), Bandikui, Rajputana, India.

**February "Questions Contest No. 7."**—First: A. G. Fellows (29952), Auckland, New Zealand. Second: G. E. Schulz (15425), Coromby, Australia. Third: A. McIntyre (30925), Winnipeg, Canada. Fourth: R. A. Wragg (7913), Bandikui, Rajputana, India. Consolation Prizes: W. G. Hallack (17578), Capetown, S. Africa; W. R. Hondelink (25394), Japan; D. Murison (37642), Buenos Aires, S. America.

**February "Railway Photo Contest."**—First: G. Healy (43145), Prince Albert, Canada. Second: G. E. Schulz (15425), Coromby, Australia.




## Branch News

FIRST SHEFFIELD.—Much work has been done on various track extensions and improvements. Additions have been made to one of the terminal stations, new scenic effects have been incorporated, and miniature roads have been included on which are run associated services maintained by motor and trolley buses, and tramcars. The layout is modelled on an imaginary section of the L.N.E.R. in the neighbourhood of Carlisle, and both L.N.E.R. and L.M.S.R. stock are used. All new locomotives added to the Branch stock are fully tested before being put into regular service, so that the most suitable duties for them can be determined. Through the kindness of a friend interested in the Branch, members have the use of an excellent workshop where repairs and new construction can be carried out. Future arrangements include a visit to a local cutlery works; it is intended also to pay a visit to London and make a round of the various stations. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield, 8.

FOREST SCHOOL.—The Branch layout is now arranged on a raised substructure and the result is a great increase in the convenience of operation. It is proposed to work out a system of timetables for use when members are more accustomed to the running of the line. Definite duties will then be allotted to each member. In addition to the regular meetings, there are usually several members present in the Branch Room each night. Secretary: H. J. Pye, Forest School, Nr. Snaresbrook, E.17.

HOLYWELL (OXFORD).—With the commencement of the Summer Session indoor track meetings have been suspended and operations are now carried out on an outdoor line. Some interesting services have been operated and a discussion on real railways was a feature of one of the recent meetings. Successful visits have been exchanged with The Priory Branch, High Wycombe. Secretary: J. Spicer, 28, Holywell, Oxford.

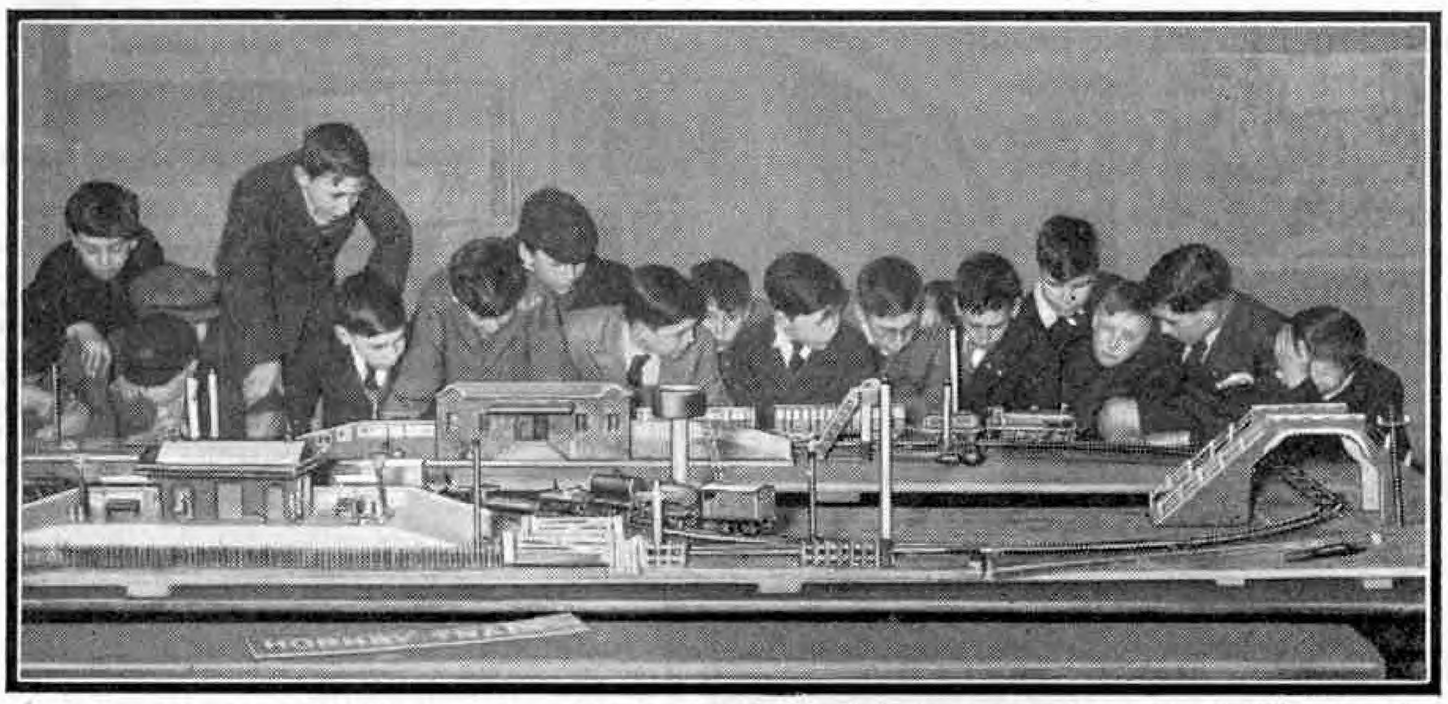
THE PRIORY (HIGH WYCOMBE).—Important alterations have been effected on the Branch layout, and experiments have been made with a new timetable which provides for the running of more trains. A separate electric layout of gauge "OO" is being constructed. It is intended to finish this as soon as possible. Visits have been exchanged with the Holywell (Oxford) Branch and interesting work was carried out on each occasion. A visit was paid to the Model Railway Club Exhibition, and to the Bekonscot Miniature Railway that was described in the "*M.M.*" for April 1934. There is still room in the Branch for keen new members. Secretary: J. T. Cosgrove, 54, Priory Road, High Wycombe, Bucks.

ELMSIDE (EXETER).—Recent Branch meetings have followed the normal course. The method of conducting operations at track meetings is of interest, One member is chosen as Superintendent for the occasion. He selects a number of members as his staff to work the trains for a given period, and at the end of this time they are relieved by others. This process is repeated until all members present have had a turn at operating. The remainder of the time is spent in shunting operations, in working special trains and in general experimenting. It is proposed to allot names to the various expresses that figure in the Branch timetable. It is suggested also that some form of "ticket" or "working sheet" for members on duty would add to the general interest. Secretary: T. W. A. Smith, 98, Ladysmith Road, Exeter.

RAVENBURY (MORDEN).—Discussions on the various types of layouts have been held and track meetings have been arranged. Membership is increasing slowly, but it is hoped to arrange a series of Visits and other events that will attract further members. Secretary: A. M. Evans, 31, Arras Avenue, Morden, Surrey.

NORTHAMPTON.—In the last few meetings before the commencement of the Summer Session, Games and Competitions formed the chief interest. Outstanding matches were played off and the different contests finally concluded. At a track meeting a new system of awarding points for the work of members was tried and found satisfactory. A recent Lantern Lecture was greatly enjoyed, as were visits to Roade station and to Rugby Motive Power Depot, L.M.S.R. At Rugby members were conducted through the sheds and observed the new coaling plant in operation. A very popular feature of this visit was a detailed inspection of an L.M.S.R. Standard Compound locomotive, members being allowed on the footplate and also into the inspection pit below the engine. It is hoped to be able to arrange for a similar visit to Wellingborough Motive Power Depot. A Tennis Tournament has been proposed and it is suggested also to commence the publication of a Branch Magazine. Secretary: D. K. Adams, 8, Cedar Road, Northampton.

ST. STEPHENS (SALTASH).—Both indoor meetings and outdoor functions are held during the Summer Session, and it has been decided to arrange these alternately. Plans for a further section of the layout including 12 points have been approved. Indoor games were enjoyed at one meeting, and cricket and baseball are played out-of-doors. A Cycle Run was held to visit the Plymouth airport at Roborough. Plymouth Meccano Club have, through their Leader, extended to the Saltash Branch an invitation to combine with them for any works visits that may be held. Secretary: B. Braund, 9, Homer Park, Saltash.



**Members of the Hornby Railway section of the St. John's School (Bridgwater) Meccano Club. Chairman, Mr. C. J. H. Sanderson. Secretary, L. R. Temple. The keen interest taken in Hornby Trains by this club is shown by this photograph of the layout operated at a recent exhibition.**

## Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation, and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below.

BARNSLEY—G. Hunt, 65, Cope Street, Barnsley, Yorks.

EPSOM—J. Spooner, 20, Long Grove Road, Epsom, Surrey.

## Branch Recently Incorporated

307. NEWTON ABBOT—H. W. Tompkins, 15, Union Street, Newton Abbot.

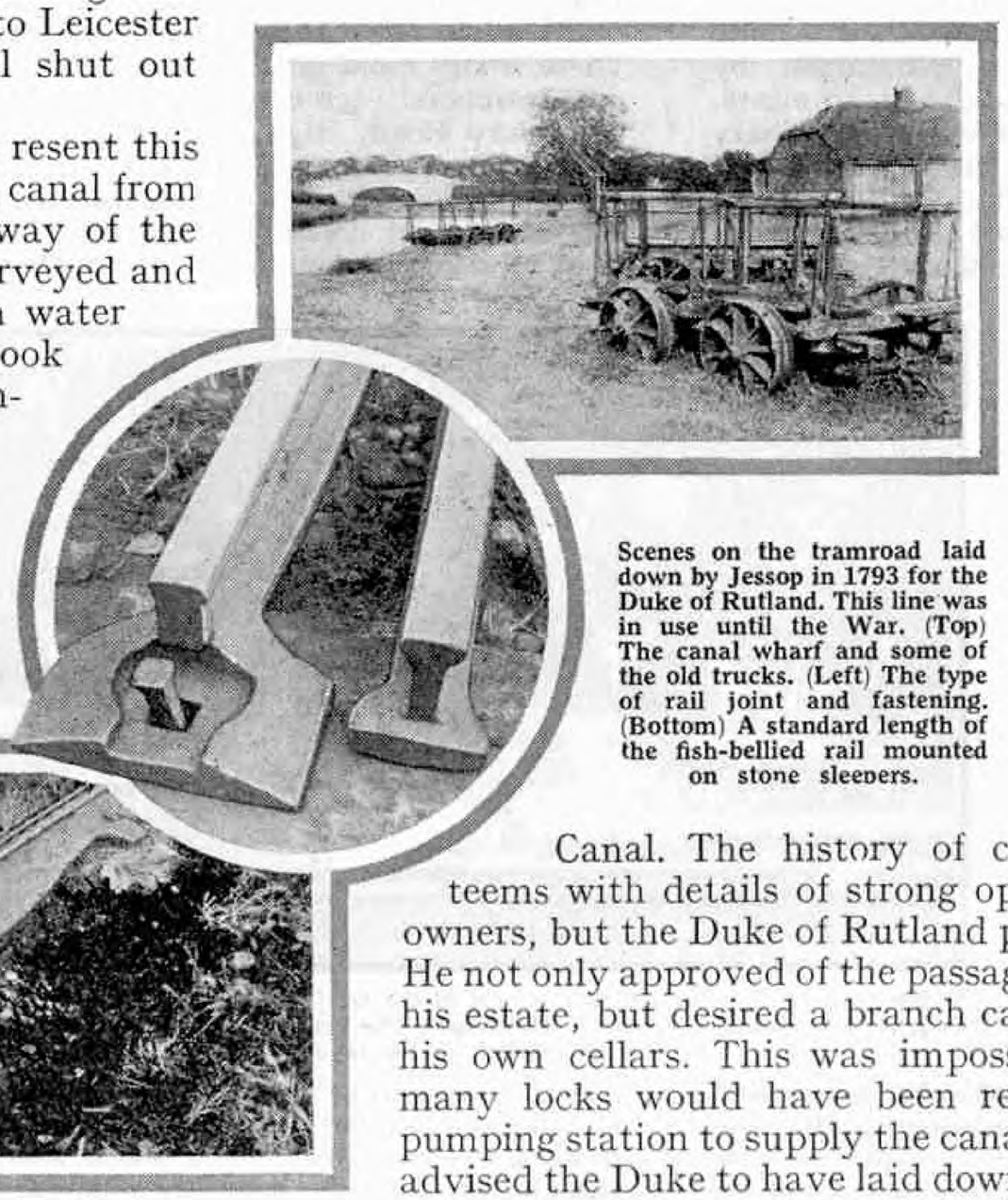
# Early Coal Transport in the Midlands

## Canals, Plate-ways and Railways

By T. G. Earp, B.Sc.

BEFORE 1780 the coal mined in the Leicestershire and Nottinghamshire coalfields was conveyed to market by horse and road transport. This method was extremely unsatisfactory; costs were high, roads bad, and the services so unreliable that the colliery owners were looking out for improved means of communication, especially for one which would favour their own coalfields. At first the Leicestershire coalfields were better situated for the Leicester market than were the Nottinghamshire mines. But later with the construction of canals Nottinghamshire coal could be conveyed very cheaply to Leicester by water, leaving the Leicestershire coal shut out of its natural market.

So strongly did the Leicester coalowners resent this intrusion that it was decided to construct a canal from the Swannington pits to Nanpantan by way of the north of Charnwood Forest. This canal, surveyed and directed by W. Jessop, was supplied with water from a reservoir situated in the Black-brook Valley and is now the site of the Loughborough water supply. Owing to the difference in height of 250 ft. between Nanpantan and Loughborough it was found necessary to construct a tramway to connect the canal with the River Soar. This tramway was designed by James Outram, and consisted of cast iron plates 3 ft. long mounted upon a stone foundation. In order to keep the trucks on the road the plates were shaped like the letter L, and were arranged so that the small lip or flange projected upward on the inside edge of each rail.



Scenes on the tramroad laid down by Jessop in 1793 for the Duke of Rutland. This line was in use until the War. (Top) The canal wharf and some of the old trucks. (Left) The type of rail joint and fastening. (Bottom) A standard length of the fish-bellied rail mounted on stone sleepers.

The material for the construction was delivered and work started on the 3½ miles of track, and then arose the question of crossing the London-Derby road, now "A6." Unfortunately Outram had not mentioned in his report to the Royal Commission that the flat plates were equipped with a flange or ledge that would stick up from the road and perhaps cause inconvenience to the users of the highway. When this was discovered by the Commission, they not only forbade the laying of rails with an upstanding ledge across the main road, but would allow no such obstruction on any other road. This resulted in the scheme being abandoned, and the plates already laid were taken up and returned to the foundry.

Jessop, the canal engineer, suggested that the flat type of wheel that was to run on the Outram-way should be replaced by the flanged type running on an edge-rail. Jessop therefore attended a meeting of the Royal Commission and asked "to be allowed to lay down two plates of iron, perfectly flat and level with the road, but each to have on the outside a groove ¾" wide and ¾" deep to control the guiding wheel," "guiding wheel" being the term used to denote the flange. Jessop's edge-rails were cast in 1788 and laid down in that year to the gauge of 5 ft. The original trolley used for the work had outside flanged wheels that were cast in one piece. During the construction of the line, however, Jessop realised the limitations of the outside flange, and decided to change to the inside-flanged wheel in order, as he reported to the Royal Commission, to avoid the use of fastenings for the wheels. This track was made up of iron rails mounted on wooden sleepers.

In 1790-91 Jessop surveyed the Nottingham-Grantham Canal with a view to opening up new markets for the Erewash coalfields via the Langley Mill - Nottingham Canal. The history of canals and railways teems with details of strong opposition from landowners, but the Duke of Rutland proved an exception. He not only approved of the passage of a canal through his estate, but desired a branch canal to carry coal to his own cellars. This was impossible, however. Too many locks would have been required, and also a pumping station to supply the canal with water. Jessop advised the Duke to have laid down an "edge-railway," now contracted to "railway," similar to the Loughborough line.

The Duke visited this track and consented to have a similar track laid down. The new line was to be 2½ miles long and made of rails mounted on wooden sleepers. At that time Jessop was a partner in the iron founders Outram, Jessop, Wright, and Beresford, of Buttery; and no sooner did Outram see the order for the rails than off he went to the Duke of Rutland and urged him to have laid down an "Outram way" instead of his partner's railway.

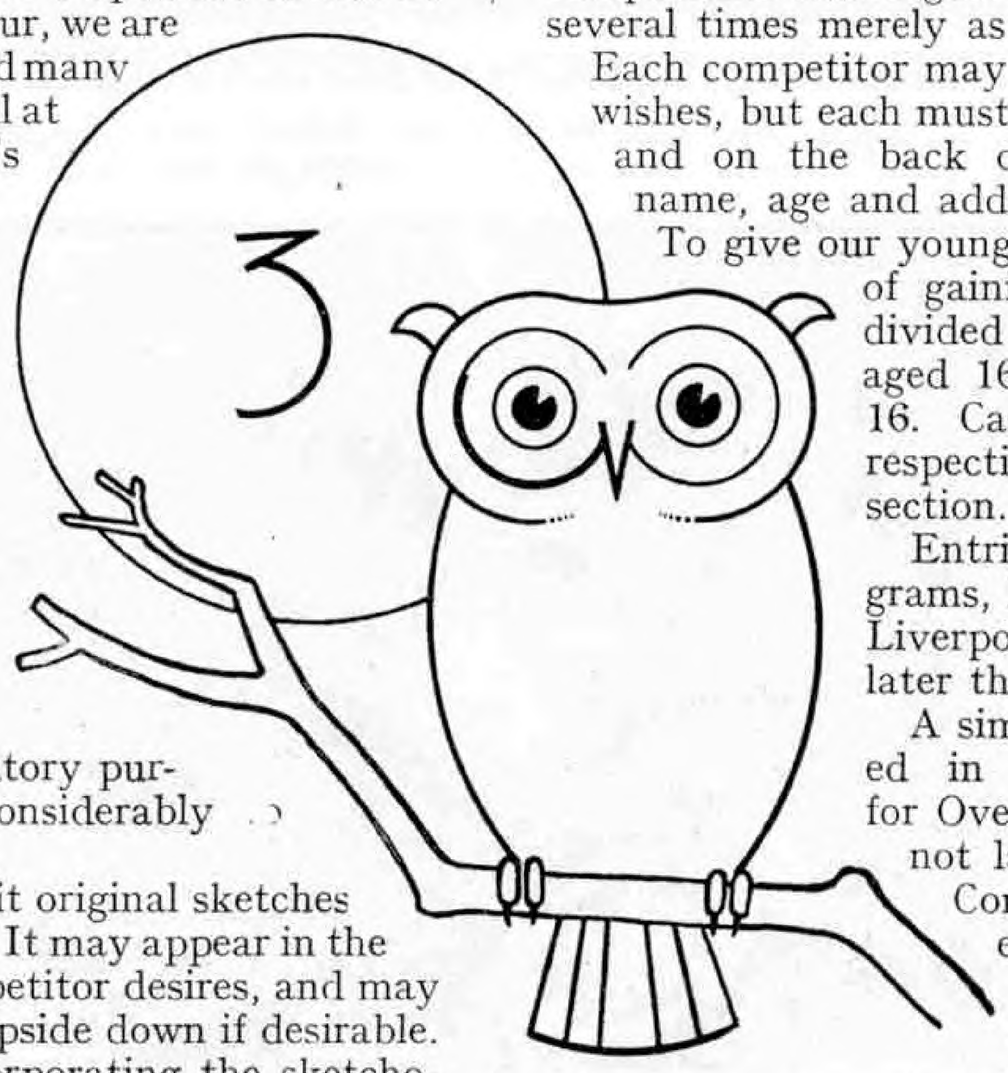
After hearing Outram, the Duke of Rutland had laid down two experimental tracks, one of each kind. He finally decided to adopt the railway proposed by Jessop, which was to be mounted on stone sets instead of wooden sleepers, in order to give the horses an unobstructed footway. This line was laid down in 1793 and one of the accompanying illustrations shows the type of rail used. These rails weighed 40 lb. and were 3 ft. in length and 3 in. deep at the ends; the depth increased to 5 in. at the middle.

# Competition Corner

## A NEW SKETCHOGRAM CONTEST

All the Sketchograms competitions we have featured in the past have proved exceptionally popular and because this intriguing form of sketching is a splendid means of whiling away an odd rainy half-hour, we are sure that all our artistic readers, and many of those who boast no drawing skill at all, will welcome this month's competition.

For the benefit of new readers we must explain that the production of sketchograms calls for no greater skill than the ability to include a given line in a simple sketch. To make the point clear, our accompanying sketch shows a sketchogram in the middle of the moon shining over the owl's right shoulder, and the sketchogram itself is incorporated in the outline of the owl's eyes and beak. For explanatory purposes it has been thickened considerably to make it clearly visible.



Competitors are asked to submit original sketches in which this sketchogram is used. It may appear in the sketch as many times as the competitor desires, and may be tilted to any angle or turned upside down if desirable. Competitors who succeed in incorporating the sketchogram more than once will be given credit for the effort, but it is important to bear in mind that a simple drawing in which it appears effectively once, and is immediately obvious, will stand a better chance of success than a complicated drawing in which the sketchogram appears several times merely as a minor feature.

Each competitor may submit as many drawings as he wishes, but each must be on a separate sheet of paper, and on the back of each sheet the competitor's name, age and address must be given.

To give our younger readers an equal opportunity of gaining a prize the entries will be divided into two sections, A for readers aged 16 and over, B for those under 16. Cash prizes of 21/– and 10/6 respectively, will be awarded in each section.

Entries must be addressed "Sketchograms, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st July.

A similar set of prizes will be awarded in exactly the same conditions for Overseas entries, which must arrive not later than 31st October.

Competitors who desire their entries to be returned after the close of the contest must send a stamped addressed envelope of suitable size with the entry. Prizewinning entries are retained by the Editor and can be returned only in special circumstances.

## July Photo Contest

Our photographic competitions this summer, as was announced in the April "*M.M.*," are open to photographs of any size or subject made with any make of camera, film, plate or paper.

The prizes are awarded each month to the best photographs submitted, and for the purpose of judging, the entries are divided into two sections, A for readers aged 16 and over, B for those under 16. Cash prizes of 21/– and 10/6 will be awarded in each section.

Only two restrictions are imposed: that the exposure shall have been the work of the competitor himself and that each print must bear a title. Prints may be professionally finished but, all other things being equal, preference is given to those entries that are solely the work of the competitor. Competitors who have developed and printed their own entries should mark the prints "Own work throughout."

Entries to the July competition must be addressed "July Photo Competition, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st July.

A separate set of prizes, to be awarded in exactly the same conditions, will be reserved for Overseas readers, whose entries must arrive not later than 31st October.




**FEBRUARY CROSSWORD PUZZLE. To enable interested readers to check their solutions to this puzzle, we give herewith the solution. The results of the Overseas Section of the competition appear in the adjoining column; those for the Home Contest appeared in the April issue.**

### Note to Intending Competitors

Readers taking part in competitions that are divided into separate age groups are asked to note that it is not sufficient to indicate merely the group for which the entry is intended. The competitor's age must be stated on each entry.

## COMPETITION RESULTS

**May Photo Contest.**—The popularity of our photographic contests is increasing year by year, and readers will be interested to know that the entries for the first two contests of this season, announced in the April and May issues, have shown a 50 per cent. increase in numbers over those of last year.

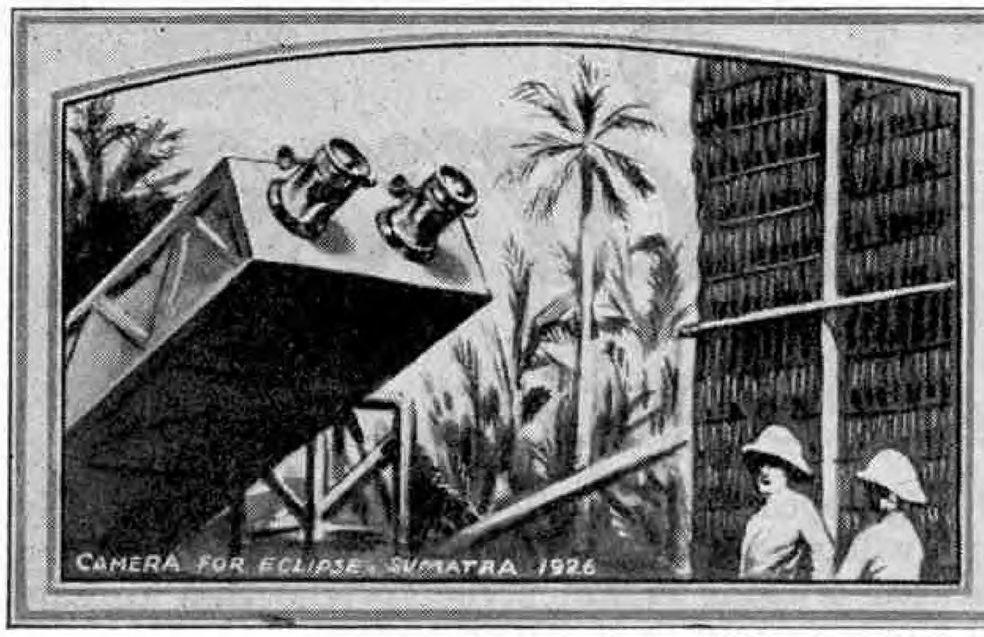
Many splendid photographs were submitted to the May Contest and the judges had considerable difficulty in deciding the final placings. The First Prize in the A Section was awarded to C. P. Silver of Exeter for a very pleasing picture entitled "*In Newlyn Harbour.*" J. R. Tottle of Taunton gained the First Prize in Section B for a rather unusual study entitled "*Landing,*" made in Weymouth Harbour. The subsidiary awards were as follows: Second Prizes: Section A, V. L. Breeze (Lewes); Section B, P. W. Sadler (Bromley). Special Prize: I. D. Moggach (London, N.W.2). Consolation Prize: D. R. Rooke (Goodmayes).

**May Crossword Puzzle.**—The more we study the entries to our crossword puzzles the more we marvel at the amazingly sustained interest that is taken in crossword puzzles. Certainly no other form of competition has achieved and retained such tremendous popularity, and it is evident that we cannot give our readers too many of them.

The "*M.M.*" puzzles are set for amusement only and, as our readers know, it is our practice to award the prizes to the correct entries showing the neatest and most novel presentation. It is always difficult to discriminate between the leading entries, and the four prizewinners in the May competition, whose names appear below, deserve every congratulation upon their success. The awards were as follows: 1. H. McLachlan (Edinburgh, 10); 2. B. Hardie (Bristol, 9); 3. R. Richards (London, E.5); 4. L. V. T. Medlin (Par, Cornwall).

### OVERSEAS

**February Crossword Puzzle.**—1. J. R. Dingle (Halifax, N.S., Canada); 2. E. A. Fester (Wynberg, S. Africa); 3. J. D. Malan (Melbourne); 4. C. Keekok (Singapore).




# PHOTOGRAPHY

## TAKING ACTION PHOTOGRAPHS

MOST photographers like to take action pictures and during the summer will be on the look out for opportunities of doing so. These are not difficult to find in the outdoor season, when such events as school sports will give the possessor of even a small fixed focus box camera good pictures. A little thought is necessary before any attempt to take such photographs is made, however. The highest shutter speed of a camera of this kind is likely to be 1/30th or 1/25th of a second. An exposure of this length is useless for such an event as the finish of a mile cycle race if this is photographed from a short distance, for the speed of the competitors is so high that their figures will appear on the print as mere blurs. If a photograph of a speedy race must be taken with a slow shutter, it is best to work at a good distance, say, 40 yds., and to enlarge the small snaps.

There are dozens of incidents during a sports meeting that can easily be photographed well with a small camera, however. In many of the events there are moments when the motion of the competitor is practically suspended, and by acting quickly excellent results can be obtained. An instance of this is the start of a race, when the runners are crouched at their marks in readiness to move the instant they hear the starter's gun. Other examples are the change-over in the relay race and the action of taking the strain in the tug-of-war.

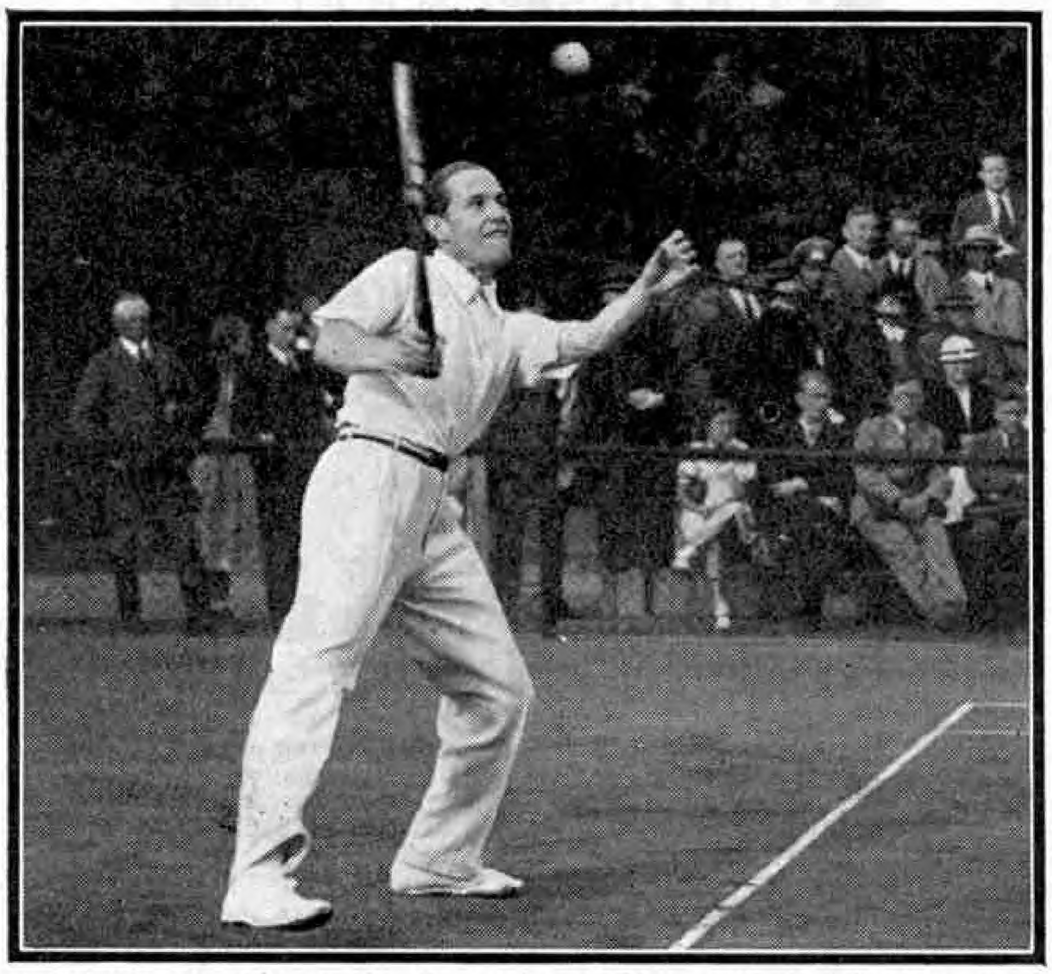
Similar opportunities for successful snaps are provided by the high jump. In the former there is a moment when the jumper's upward movement ceases and he begins to drop towards the ground. Then is the time to obtain a good photograph, and this will be most effective if a low viewpoint is chosen in order to give the effect of height. A jumper who is deliberate in his movements should be selected as the subject rather than one who rushes at top speed towards the bar and flings himself over it.

The tennis court and the swimming pool are happy hunting grounds for the amateur in search of action photographs. There again it is best to wait for moments when little or no movement is actually taking place, and many good pictures taken at times such as this carry with them a surprisingly good suggestion of speed. The service of a tennis player provides an excellent example, and similarly first-class pictures can be obtained when a diver is poised for his plunge into a swimming pool. Such an event as a motor cycle trial also is well worth attention, and there the best pictures are those taken when the machines are tackling awkward corners, or making their way through water splashes or rough going.



A tense moment on rough going during the Scottish Six Days' Trial. Photograph by courtesy of Ilford Limited.

Photographing railway engines in movement is particularly interesting, and will appeal strongly to many readers of the Magazine. The speed at which the engines travel is an important factor. It is useless to try to photograph a main line express travelling at high speed with an ordinary hand camera, but this need not deter the amateur photographer. If he resorts to strategy, and photographs an engine when it is emerging from a station, he will probably get more impressive results than if he were successful in photographing it at high speed, for it makes more fuss and gives out more steam and smoke when starting a heavy train from rest than when running along the level. Some of the most successful railway photographs are those showing a comparatively slow train just starting, or perhaps approaching the summit of a severe incline, where it is "breathing hard," and in all cases the impression of movement is very decided.



A splendid action photograph on the tennis court, taken with a Voigtlander camera.

Moving objects are difficult to centre on the plate or film with the aid of a small view finder, and for this reason the position from which to take an action photograph should be chosen beforehand. In the case of a train it is best to make the exposure when the engine reaches a certain point, marked by a signal or some other lineside object. This will spare the photographer the annoyance of finding that the engine has passed out of his picture, or appears only as a small object in the distance. A similar practice should be followed when taking other photographs of this kind, and all that is then necessary is to press the shutter release gently and firmly at the right moment. A hurried snatch at the trigger is almost sure to jerk the camera, and to displace the position of the image, so that above all things the photographer should keep a cool head. A few failures in timing may be expected in early attempts, but after a little practice the exact moment for exposure will be chosen almost by instinct.




# Stamp Gossip

## and Notes on New Issues




### Bermuda Pictorials

Contrary to the rumoured intention of the authorities to use a portrait of King Edward VIII in certain of the new Bermuda pictorials, the new stamps have been issued bearing the portrait of King George V in the designs used for the 1d., 1½d., 2½d. and 1/– values. It is intended to substitute a portrait of King Edward in due course.




It is probable that this will be the last Colonial issue bearing King George's portrait, and thus there is a chance that there may fall to Bermuda the distinction of producing both the last King George issue and the first King Edward issue.

The new issue is a series of nine stamps, ½d. to 1/6 values, with designs as follows: ½d. and 1/6, a view of shipping in the harbour at Hamilton, capital of Bermuda; 1d. and 1½d. seacoast at South Shore, with portrait inset; 2d., a racing yacht under full canvas, a very happy design in view of the fact that Bermuda is a famous yachting centre; 2½d. and 1/–, Horse Shoe Bay, one of the island's most beautiful coral beaches, with King George's portrait; 3d., a typical homestead, built of white coral stone, with a specimen of the indigenous palmetto tree in front of the house; 6d., Par la Ville public gardens and library.

The library shown on the 6d. value was formerly the residence of Mr. W. B. Perot, the island's first postmaster, and the office building from which the famous Bermuda Postmaster stamps of 1848 were sold is still to be seen at the entrance to the gardens. The building is now used as a museum by the Bermuda Historical Society.

* * *

To celebrate the 40th anniversary of the founding of the Spanish Press Association, Spain has issued a series of commemorative stamps. The design that will appeal most to our readers is that illustrated here, used for the 2 p., 4 p., and 10 p. values. This shows Don Quixote and his trusty servant Sancho Panza on the wooden horse, an incident from "The Adventures of Don Quixote."

* * * *

To mark the completion of an important road-building programme, the Dominican Republic has issued a special commemorative series of four stamps each using the design illustrated here, showing the Avenue George Washington, one of the new roads.




### A Stamp Yarn

In his book, *"The Memoirs of a Royal Detective"* (Hurst and Blackett), ex-Detective-Inspector Herbert Fitch of the Special Branch at Scotland Yard tells many good stories of his adventures when guarding royalty and other distinguished personages. One of these has a philatelic flavour and is worth repeating.

Mr. Fitch was one day on duty during a royal procession when he noticed a wild-looking man with a bag in his hand trying to force his way into the front rank of the crowd. The detective stopped him and asked to see the contents of the bag, thinking they might be of a dangerous nature.

The man explained that he was an American stamp collector and, opening his bag, displayed many thousands of postage stamps of all countries. With a cunning smile he added, "But the best are not in there!" and produced from his pocket a blue




stamp which he said was *the* Twopenny Mauritius and added that he was in England to exchange it with King George.

Mr. Fitch pointed out that he could hardly expect the King to stop his State coach in order to exchange stamps in the street and suggested that he should approach His Majesty through the usual channels. The man appeared to agree, but when the royal coach drew near and everybody else began cheering, our American friend started bawling "Stamps! stamps!" at the top of his voice, to the amazement of the few people who could hear him. Evidently this appeal to his philatelic instincts did not reach the ears of the King, for the coach passed on and the American was lost in the crowd. Mr. Fitch adds that he never heard any more of the matter, but that he often wondered whether the enthusiast did eventually succeed in his formidable task of getting into touch with His Majesty and exchanging his stamps. —*Gibbons' Stamp Monthly.*




### £30 Jubilee Stamp

Among all the millions of English Silver Jubilee Stamps issued last year, only one important variety has come to light, a 2½d. value printed in Prussian blue instead of the normal ultramarine. The Post Office has authenticated the error, which owes its existence to a curious mistake.

In the course of the preliminary colour trials, some of the sheets were printed in Prussian blue and others in ultramarine, and the latter was finally chosen as standard for the issue. In the ordinary course, nothing would have been seen of the Prussian blue stamps except for an imperforate block of four that was presented to the late King George. Inadvertently, however, three sheets of Prussian blue colour trials were mis-sorted among the normal sheets, perforated and distributed to a small Post Office in North Edmonton, London. Here they were noticed by a keen-eyed collector who purchased the whole of the 319 stamps remaining in stock.

Later he disposed of them to a prominent firm of London stamp dealers and specimens are now changing hands at £30 each.

### New Zealand Anzac Commemorative

In our May Stamp Gossip notes we referred briefly to the issue from New Zealand to commemorate the 21st anniversary of the landing of the Australian and New Zealand Army Corps on the Gallipoli Peninsula. By courtesy of Mr. Errol A. Hamilton of Southland, N.Z., we are now able to give an illustration of the stamp.

The design is from a drawing by Mr. L. C. Mitchell of Wellington, N.Z., and depicts a private of the N.Z. Forces in battle order standing on a heap of sandbags, with Anzac Cove in the background. The picture is flanked on each side by laurel leaves, and the whole design is framed by a border of Maori carving. A private now serving with the N.Z. Army at Trentham Camp was chosen to act as photographic model for the design, and his accoutrements are a complete replica of those used in Anzac days.

A special first day cover was prepared for use with this issue and we have to thank several New Zealand readers for their kindness in sending specimens of this cover to the Editor.



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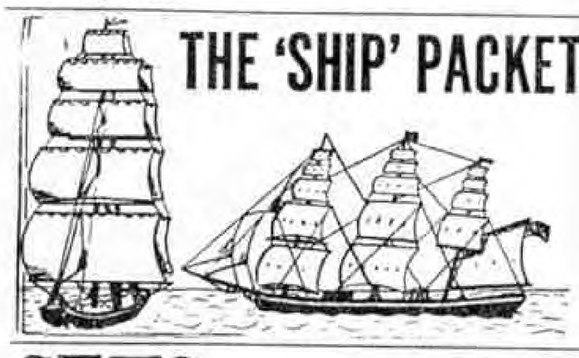
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*See also stamp advertisements on page xviii.*

### A Darwin Commemorative

Although somewhat belated in its appearance, Ecuador's set commemorating the centenary of Charles Darwin's visit to the Galapagos Islands with the *"Beagle"* scientific expedition in September and October 1835 is none the less welcome. It is a most interesting series.

The Galapagos Archipelago lies some 600 miles from the South American mainland and the islands are remarkable for their unique fauna and flora. Almost all the reptiles found in the islands, and nearly half of the plant life and the fish found in the neighbouring seas, are peculiar to the islands and exist in forms that are not matched precisely in any other part of the world. There is no doubt that Darwin was greatly influenced by his researches in these islands when compiling his famous theory of the origin of species.




The set is comprised of six stamps, 2c. to 2 sucre values, three of which are illustrated on this page.

The lowest value, 2c., shows a map of the islands. A point of special interest in the design is that 10 of the islands are given their Spanish names, but that of the eleventh, Tower Island, is given in English.




The 5c. stamp shows the Marine Iguana, the more interesting of the two species of iguana that are found in the island. Darwin studied this reptile very closely and in a diary note dated 17th September, 1835, he writes "The black lava rocks on the beach are frequented by large (2-3 ft.), most disgusting, clumsy lizards. They are as black as the porous rocks over which they crawl and seek their prey in the sea. Somebody calls them 'imps of darkness.' "




This note implies that the iguana is carnivorous but in a later note dated 9th October Darwin corrected that impression: " 'The imps of darkness' live entirely upon seaweed. I suspect such habits are nearly unique in the Saurian race."

The 10c. stamp, illustrated on page 425, shows the giant Galapagos tortoise. As many as 15 different species of tortoise are found in the Archipelago, almost a distinct species for every one of the larger islands. At one time they existed in enormous numbers, but their food qualities were so excellent that they were greatly prized by visiting sailors and were killed almost wantonly. It has been estimated that in the last 200 years or so no less than 10 millions of the reptiles have been slaughtered, and to-day certain of the species are almost extinct and seem doomed to die out.

The species illustrated in the stamp is known to live 300 to 400 years and attains a length of 4 ft. and weighs up to 400 lb. In his diary under the date of 21st September, 1835, Darwin wrote "In my walk I met two very large tortoises (circumference of shell about 7 ft.). One was eating a cactus and then quietly walked away. The other gave a deep and loud hiss and then drew back its head. They were so heavy I could scarcely lift them off the ground."

The 20c. stamp gives a portrait of Charles Darwin and a small picture of *"H.M.S. Beagle"* in which he reached the islands. The portrait is a familiar one showing Darwin as an elderly man, but it should be remembered that he was only 22 years of age when he left the university to join the *Beagle* Scientific Expedition in 1831.




The higher values of the set, 1s. and 2s. respectively, show a portrait of Columbus and a view in the islands.

### Australian Telephone Commemoratives

To celebrate the inauguration of the submarine telephone cable between Tasmania and the mainland, Australia has issued two commemorative stamps, 2d. and 3d. values, each bearing the design illustrated here. This shows Amphitrite, wife of the sea god Neptune, standing in a shell, and grasping a telephone cable in one hand. The cable is seen stretching away to its landing points, Apollo Bay, Victoria, in the left foreground, and Stanley, Tasmania, in the background.

The cable is 161 nautical miles in length and is the longest submarine telephone cable in the world.

### The Magdeburg Hemispheres

The 250th anniversary of the death of Otto von Guericke, burgomaster of Magdeburg, one of the pioneers of electrical science, has been marked in Germany by the issue of a 6 pf. commemorative stamp.

Von Guericke is chiefly notable for the experiment with the Magdeburg hemispheres, by means of which he demonstrated the power of air pressure. He made a metal globe, divided into two hemispheres that fitted perfectly together, and by means of an air pump exhausted the air from inside the globe. Then, in the presence of the Emperor Ferdinand III, he invited anyone to pull the globe apart. Ultimately 25 horses were harnessed to it before the severance was achieved. Then Guericke showed that by turning a tap in one end of the globe and admitting air, the two hemispheres could be separated easily by one man.

Later von Guericke used his hemispheres and air pump to determine the weight of the gases of the atmosphere. He did this by weighing the globe before and after exhausting the air from inside.




Von Guericke also made interesting electrical experiments. In the most famous of these he charged a globe of sulphur with electricity by rotating it on an axis and rubbing it with his hand as it spun. A piece of paper then was attracted to the globe, but in turn became charged, after which it was repelled. Not until the paper had been discharged by contact with some other object was it again attracted by the globe.

### The Best Designs of 1935

Recently *"Gibbons' Stamp Monthly"* held a competition to decide the 12 best stamp designs of 1935, and we think our readers will be interested to learn the results of the voting, which was as follows: 1. Southern Rhodesia, Silver Jubilee issue; 2. British Colonial Silver Jubilee, Windsor Castle design; 3. Belgium, Queen Astrid; 4. Cyprus, 45 pi. Forest Scene; 5. Ceylon, 15c. River Scene; 6. India, 2½ annas Silver Jubilee, Taj Mahal; 7. Canada, 10c. Silver Jubilee, Windsor Castle; 8. Cayman Islands, 5c. Hawksbill Turtles; 9. U.S.A., 3c. Boulder Dam; 10. Samoa; 3s. Falefa Falls; 11. Canada, 13c. Silver Jubilee, *Britannia*. There was a tie for the twelfth position between the French 1 f. 50 c. *S.S. Normandie* stamp and Canada's 10c. showing a Royal Canadian Mounted Policeman.

The following stamps followed closely in the list: New Zealand, 2½d. Mount Cook; Trinidad, 3c. Mount Irvine Bay; Australia, 1/6 Air Mail; and Bahamas, 8d. Flamingoes.

Obviously, the voting was greatly influenced by the interest taken in the Silver Jubilee stamps of the Empire, and it is clear that pictorial stamps are now preferred to portrait issues. It seems that beautiful or interesting scenes framed in a simple manner




make the strongest appeal to the average collector.

Eight of the leading 13 designs were illustrated in the *"M.M."* during the year.

### Dutch Summer Charity Issue

The Dutch "Summer Charity" issue that appeared in May last contains at least one portrait of interest to English collectors. This is on the 12½c. value featuring the famous scholar Desiderius Erasmus (1466-1536). Erasmus was probably the most famous scholar of his day, but spent only his childhood in Holland. Most of his time he lived in Switzerland, but on two occasions he visited England, where he became the friend of two great Englishmen, Cardinal Wolsey and Sir Thomas More.

The remaining three stamps of the series have designs as follows: 1½c. portrait of Kamerlingh Onnes (1853-1926), the well known physicist who was the first man to liquify helium (1908) and was awarded the Nobel Physics Prize in 1913. The 5c. shows Dr. Tahma (1864–1916), a statesman famous for his pioneering of social insurance principles. The 6c. shows Dr. Schaepman (1844-1903) a poet and a politician.

*We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations on this page have been made.*




## GOOD HUNTING

Mike had obtained a job at an observatory and spent most of the time watching the astronomers at the telescopes. One night an astronomer walked in, went to a telescope, and began to make observations. Just then a shooting star fell. Mike gasped. "Begorra, that was a fine shot, sir," he said with great admiration. "Why, ye hardly had time to take aim at it."

* * * *

Eager Playwright: "I wish I could think of a play to fill the audience with tears."

Theatre Manager: "I wish you could think of one to fill the tiers with audience."

* * * *

A Scotsman had to send an urgent telegram, and not wishing to spend more money than was necessary wrote this:

"Bruises hurt erased afford erected analysis hurt too infectious unconscious." (Ten words.)

The Scotsman who received it deciphered it as follows: "Bruce is hurt. He raced a Ford. He wrecked it, and Alice is hurt too. In fact she's unconscious."

* * * *

George and James were arguing about monkeys. George said that the monkey was the animal most resembling mankind.

"Monkeys!" scoffed James, "they are no more like human beings than I am!"

* * * *

Mother: "Now take your medicine like a man, Johnny."

Johnny: "No fear. It says on the bottle: 'Twice as much for adults.' "

* * * *

Teacher: "Every day we breathe oxygen. What do we breathe at night, Willie?"

Willie: "Nitrogen."

* * * *

Landlady: "Your egg is bad? Are you sure, Mr. Simpson?"

Boarder: "Well not absolutely, perhaps. I mean—er—I've only tried this end."

* * * *

"Father," said a young girl who had been to see her first football match, "how long does a man have to be a half-back before they make him a full-back?"

* * * *

## GUILTY CONSCIENCES

Parker: "What's the idea of calling your dog Swindler?"

Barker: "Oh, just for fun. When I call him in the street, half the men nearly jump out of their skins."

* * * *

"Any complaints?" asked the orderly officer, looking in at the men's mess.

"Yes, sir," said a young private, "the bread's all wrong."

"What's wrong with it?"

"Well it defies the law of gravity, sir. It's as heavy as lead, but it won't go down."

* * * *

A girl who had just returned from a holiday in Egypt was telling her mother about the Pyramids and other wonders.

"Some of the stones, mother, were covered with hieroglyphics."

"I hope, dear," said her mother, anxiously, "you were careful not to get any of them on you."

* * * *

Mother: "And don't you know that King Solomon said, 'Spare the rod and spoil the child?' "

Tommy: "Yes, but he didn't say that till he was grown up."

* * * *

Soprano: "Did you notice how my voice filled the hall last night?"

Contralto: "Yes, in fact I noticed some people leaving to make room for it."

* * * *

Visitor: "Your son is rather small for his age, isn't he?"

Proud Mother: "Oh, no; most boys of his age are overgrown I think."

## NASAL EVIDENCE

A dirty-looking boy walked into a chemist's shop, "I want some toilet soap," he announced.

"What kind?" asked the chemist.

"I want the strongest-smelling soap you've got," the boy replied. "Then mother'll believe me when I tell her I've washed my face!"

* * * *

Diner: "Waiter, what sort of bird is this?"

Waiter: "It's a wood pigeon, sir."

Diner: "I thought so. Get me a saw."

* * * *

Miss Howler: "I seldom think of my audience when I'm singing."

Miss Rapp: "But you ought to have some consideration for them, dear."

* * * *

Teacher: "Yes, Johnny, Lapland is rather thinly populated."

Johnny: "How many Lapps to the mile, teacher?"

* * * *

## ELECTRICAL TERMS EXPLAINED



## A GOOD EARTH CONTACT

*Courtesy "A.E.I. News."*

* * * *

Dentist: "Then you won't have gas, sir?"

Patient: "Certainly not! I am a director of an electric light company."

* * * *

A schoolmistress was giving her pupils a test on a recent natural history lesson.

"Now Dick," she said, "tell me where the elephant is found."

The boy hesitated for a moment, then his face lit up.

"The elephant," he said, "is such a large animal it is scarcely ever lost."

* * * *

The tram conductor handed back the sixpence to the woman passenger. "That coin is no good, madam," he told her. "It's bad."

"Ridiculous!" she said, examining the coin. "Why, it's dated 1921. Someone would surely have noticed it before this if it were bad."

## SAFETY FIRST!

"Why have you changed your name to Leslie Maurice Smith?"

"It's my wife's idea. She thinks we ought to have the initials that are on the towels!"

* * * *

Rural M.C.: "I beg to announce a small change in the programme. The interval of ten minutes will come now, after which the Reverend Mr. Peacock will sing to those of us wot comes back."

* * * *

Officer: "Now tell me, what is your idea of strategy?"

Private: "It's when you're out of ammunition, but keep on firing."

* * * *

Angler: "Yes, the fish was too small to bother with, so I got two men to throw it back."

* * * *

Visiting Captain: "Not much grass on the pitch."

Home Captain: "You came here to play football, not to graze."

* * * *

Welshman No. 1: "I never tasted such better beef in all my life any more."

Welshman No. 2: "So did I neither."

Welshman No. 3: "Neither did I too."

* * * *

Some engineers had been celebrating at a provincial hotel the completion of a big job. One old lady was somewhat shocked at their merriment as she said she had been told they were metropolitan vicars.

* * * *

Fat Man (in a cinema to little boy sitting behind him): "Can't you see, little fellow?"

Little Fellow: "Not a thing."

Fat Man: "Then keep your eye on me and laugh when I do."

* * * *

Tom: "I was shipwrecked once and lived for a week on a tin of sardines."

Bill: "You didn't have much room to move around did you?"

* * * *

## EXPLAINED

"Pap," said the coloured youth, "A'd like ye to explain de way dat de telephone works."

"Dat's easy 'nuff, Rastus," said the old man. "Hit am like this. Ef dere was a dawg big nuff so his head could be put in Boston, an his tail in New York, den if you tramp on his tail in New York he'd bark in Boston. Understand Rastus?"

"Yes, Pap. But how am de wireless telegraph worked?"

"Jess prezactly de same way, Rastus, wid de exception dat de dawg am 'maginary."

* * * *

Billy (staying on uncle's farm): "There's a mouse in the milk pail."

Uncle: "Did you pull it out?"

Billy: "No; but it's all right—I put the cat in."

* * * *

A traveller entered the local inn and proceeded to shake the water from his clothes.

"Heavens!" he exclaimed. "Very rough weather for this time of the year, isn't it?"

One of the locals nodded and said: "Ay, that it is. Last night's storm were the worst as ever I seed. It blowed down trees as 'ad never been blown down afore."

* * * *

Teacher: "Tommy, how many bones have you in your body?"

Tommy: "Nine hundred."

Teacher: "Then you have a great many more than I have."

Tommy: "That is because you didn't have fish for breakfast as I did."

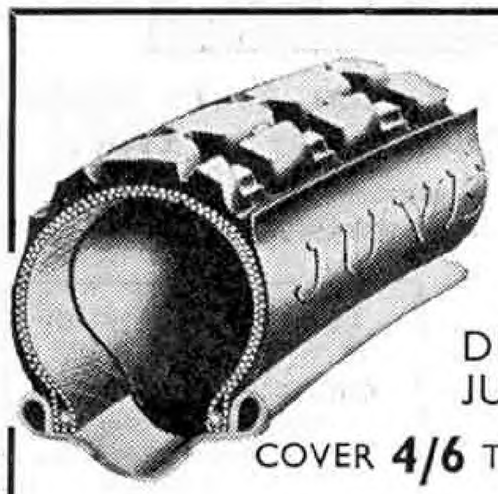
* * * *

A very fat man came in to bat and took his centre. The bowler started to bowl, stopped and turned to the umpire.

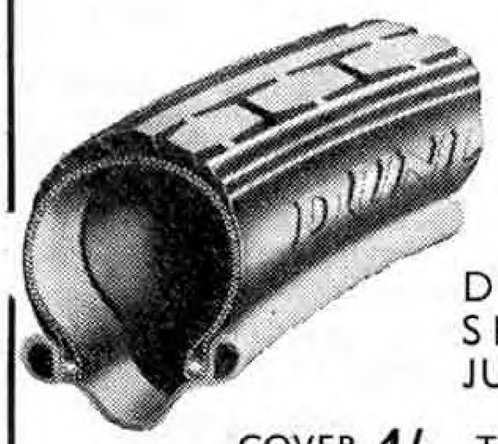
"Hang it all, Bill, what be I to do, his legs is clear, but his tummy is covering all the bails."

"It's all right, Garge, thee go on bowling, if thou hits him in front, it's leg afore, if thou hits him behind, it's a wide!"

# BOYS!



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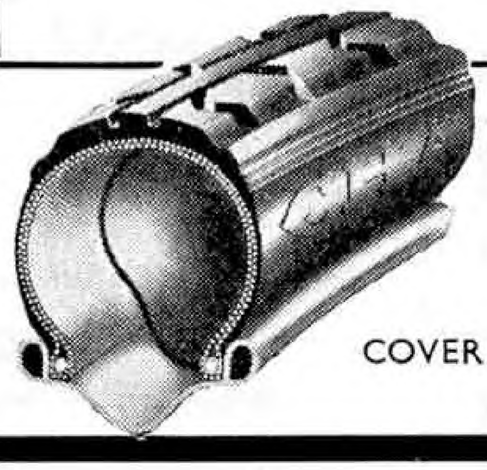


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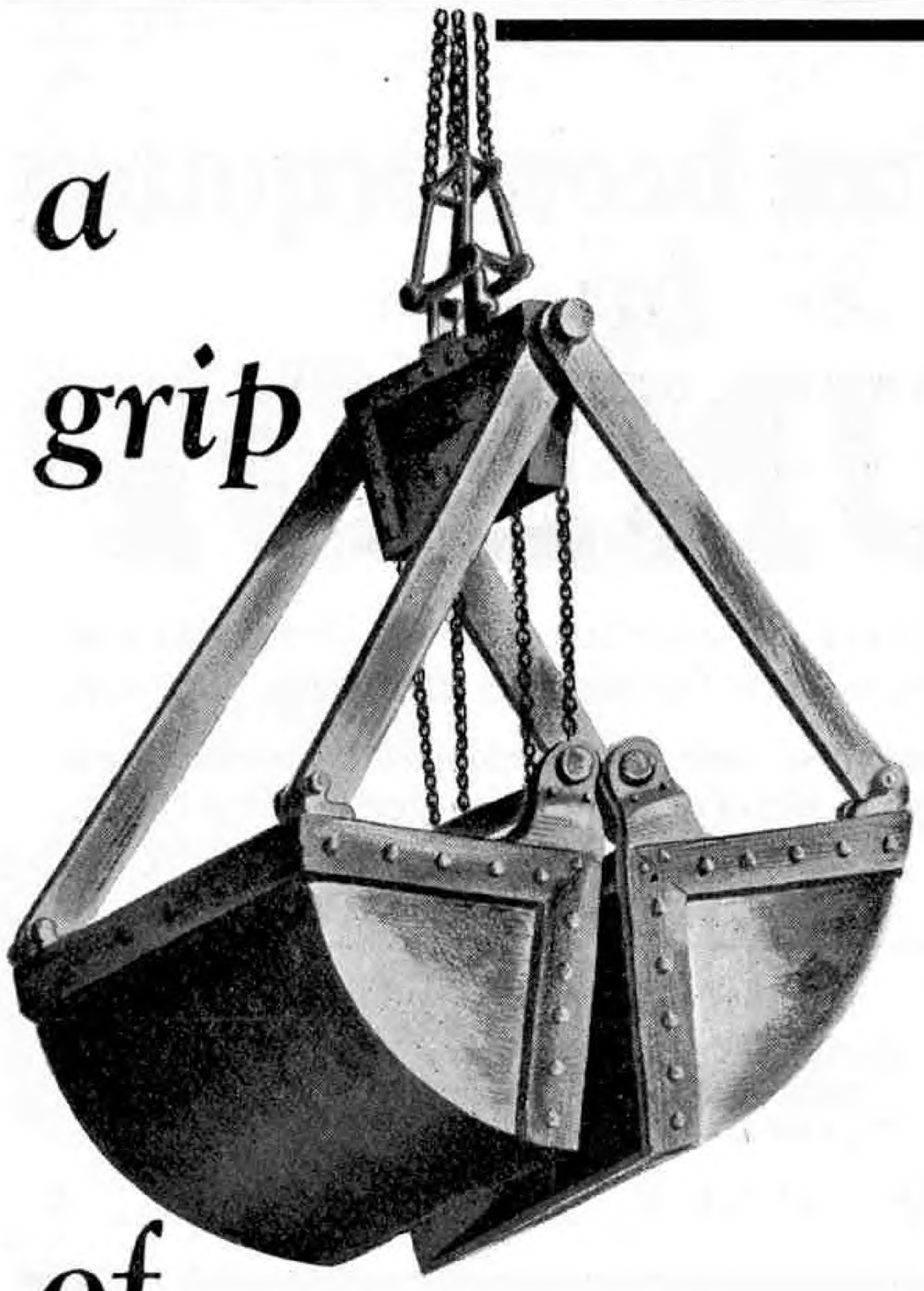
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*(Neg. by Chas. E. Brown.)*

*a grip*



*of*

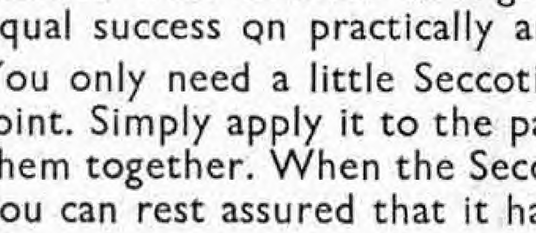
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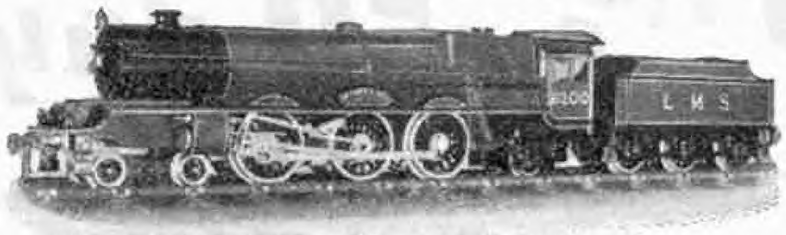
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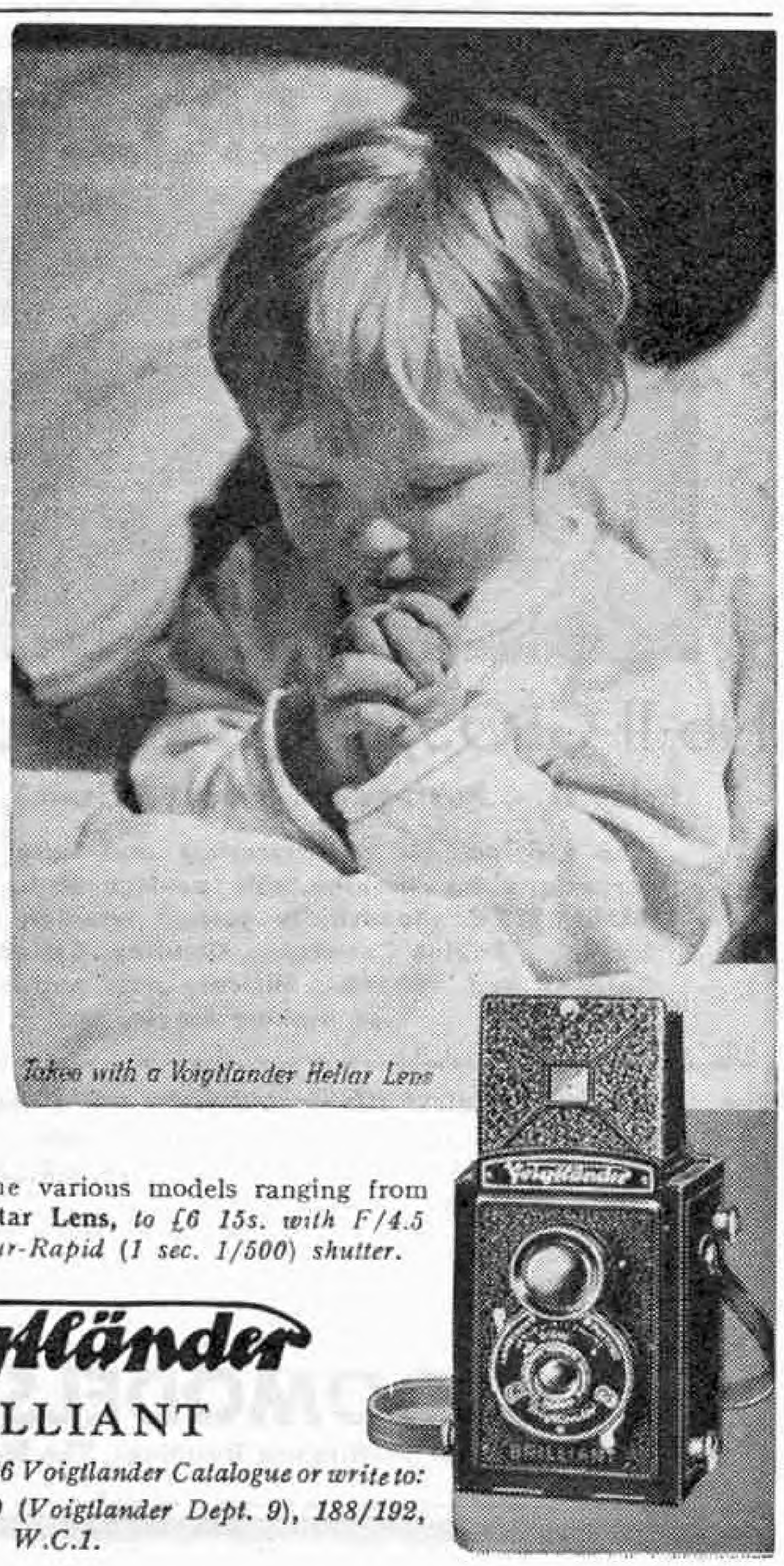
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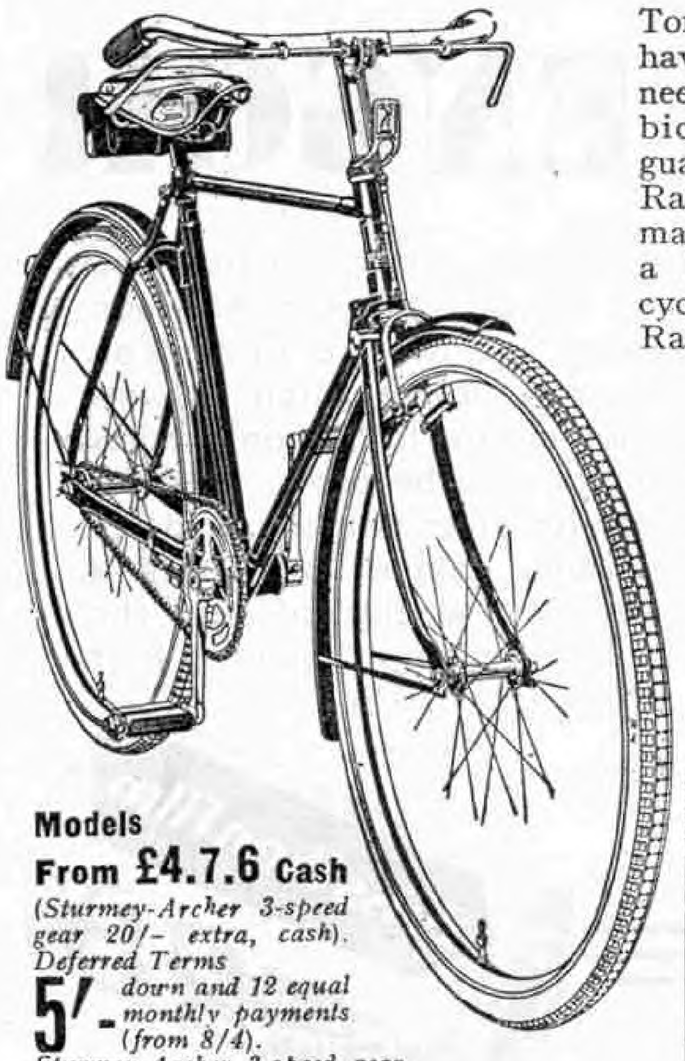
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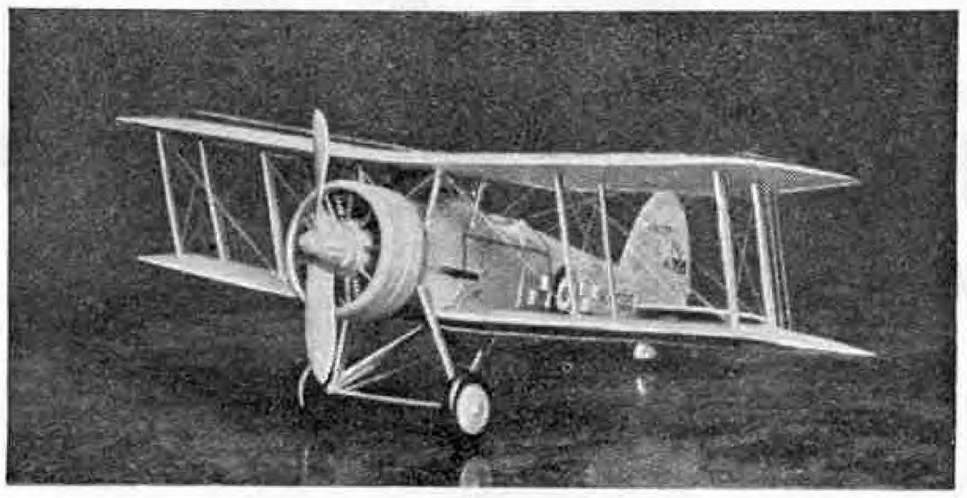


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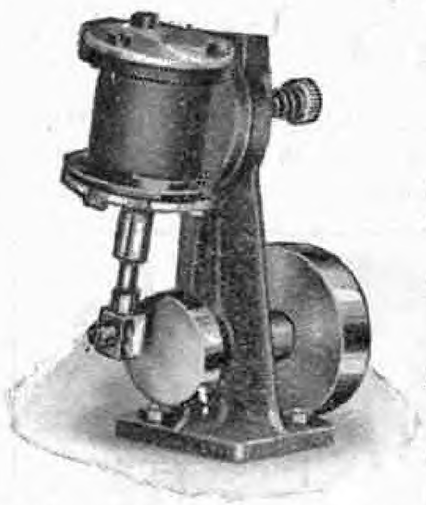
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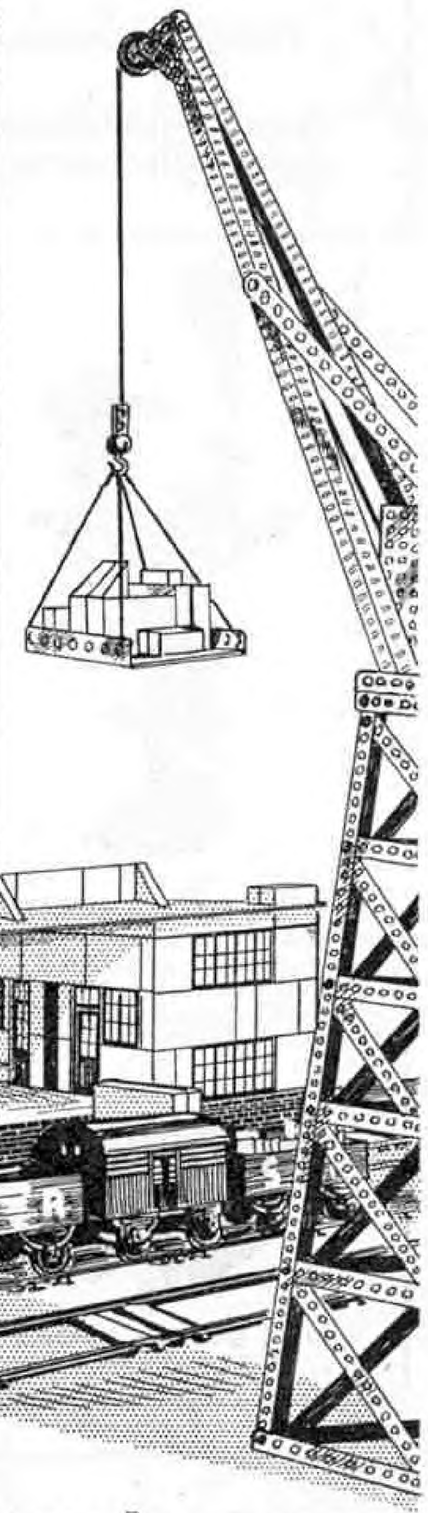
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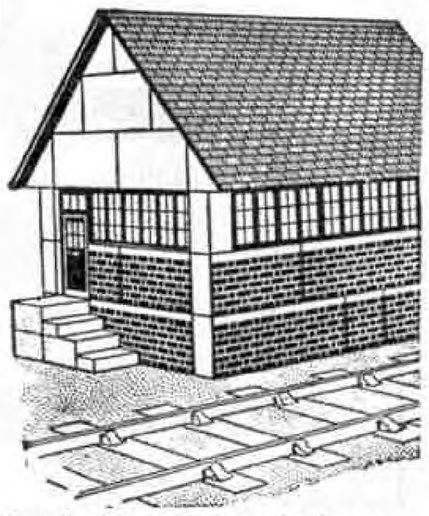


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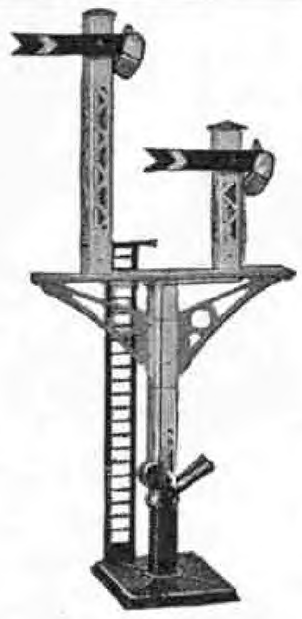
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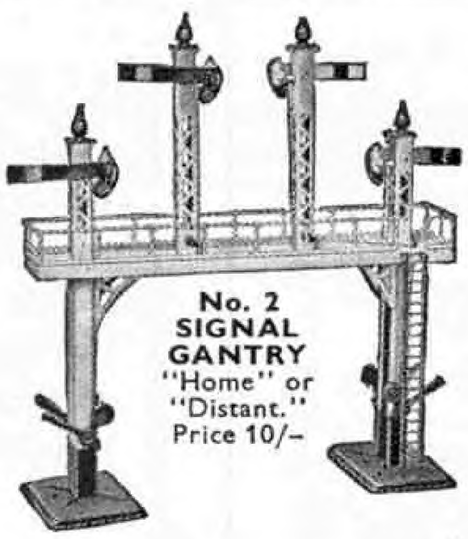
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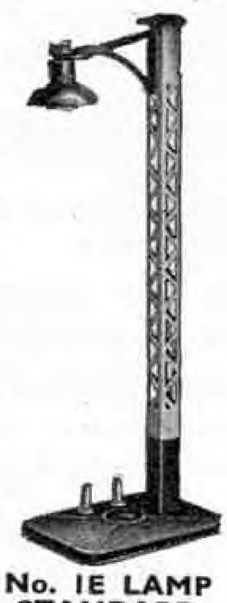
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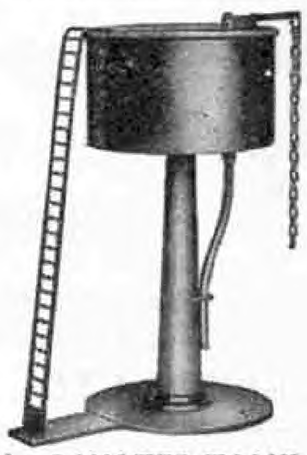
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"Home" or "Distant."
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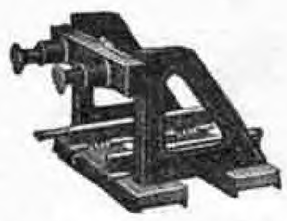
**No. IE LAMP STANDARD (Single)**
Price 2/11



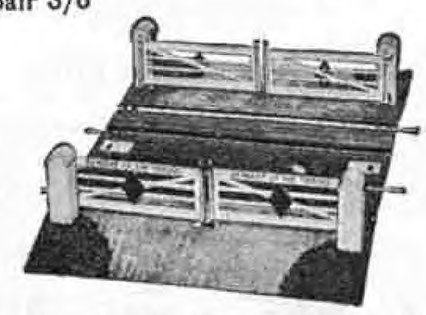
**No. 2 WATER TANK**
Fitted with flexible tube and valve lever. Stands 8½ in. high. Price 5/9



**No. 2 SIGNAL**
"Home" or "Distant."
Price 2/-

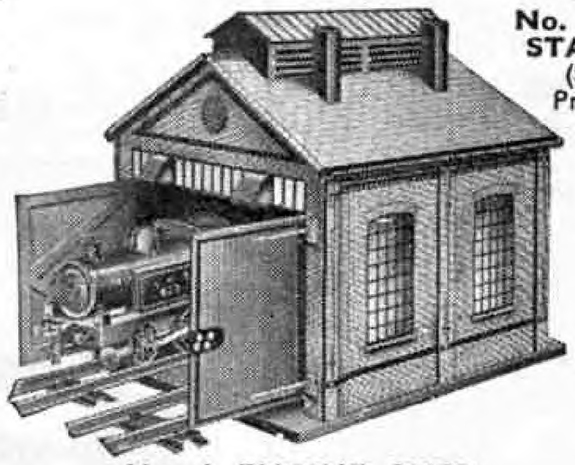


**No. 1 BUFFER STOPS**
(Spring type). Price 1/-

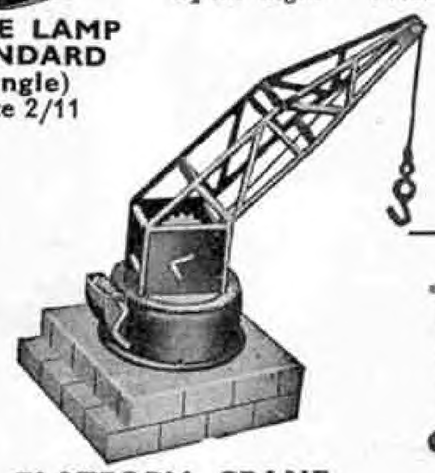


**No. 2 LEVEL CROSSING**
Measures 13½ x 10½ in., with two tracks of gauge O rails in position, as illustrated. Price 5/6

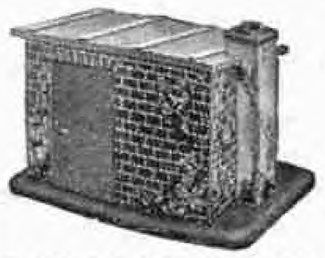
**No. 1 LEVEL CROSSING**
Suitable for single track only. Price 2/11



**No. 1 ENGINE SHED**
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 8¾ in. Price 15/-



**PLATFORM CRANE**
Fitted with a crank handle and ratchet mechanism. Price 3/11



**PLATELAYER'S HUT**
Price 1/-

# HORNBY RAILS, POINTS and CROSSINGS

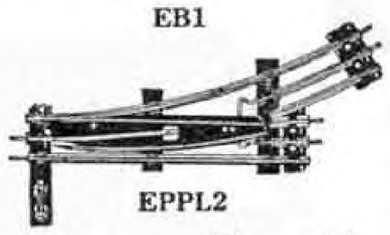
GAUGE 0, 1¼". HORNBY SERIES.

Hornby Rails, Points and Crossings are built for hard wear and for smooth running.

There is practically no limit to the number of rail formations that can be built with them. Their adaptability is well shown in the booklets "How to Plan your Hornby Railway" and "Hornby Layouts–100 Suggestions," both of which may be obtained from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d.



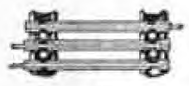
EB1



EPPL2



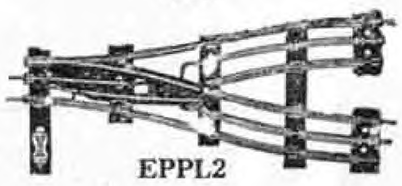
EA2½



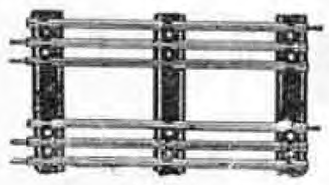
EB½



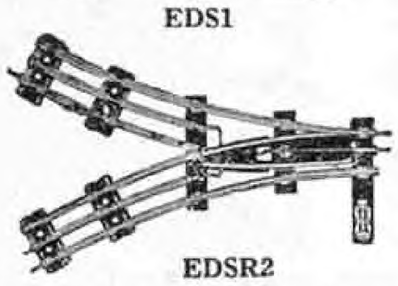
EA2



EPPL2



EDS1



EDSR2

## A SELECTION OF RAILS, POINTS AND CROSSINGS FOR ELECTRIC TRAINS

EB1 Straight rails ... ... per doz. 5/-
EB½ ,, half rails ... ,, ,, 4/6
EA2½ Curved quarter rails (2 ft. radius) ... ... ,, ,, 4/-
EA2 Curved rails (2 ft. radius) ,, ,, 5/-
EPPR2 Parallel points, right-hand ... ... ... } per pair 7/-
EPPL2 Parallel points, left-hand ... ... ... }
These points can be used for either 1 ft. or 2 ft. radius tracks.

ESPSR2 Right-hand points (2 ft. radius) ... ... } per pair 7/6
ESPSL2 Left-hand points (2 ft. radius) ... ... }

EPR1 Right-hand points (1 ft. radius) ... ... ... } per pair 5/9
EPL1 Left-hand points (1 ft. radius) ... ... ... }

EDS1 Straight rails, double track ... ... ... ½ doz. 8/6

EDSR2 Double symmetrical points, right-hand (2 ft. radius) ... ... ... } per pair 7/-
EDSL2 Double symmetrical points, left-hand (2 ft. radius) ... ... ... }

EDSR1 Double symmetrical points, right-hand (1 ft. radius) ... ... ... } per pair 6/-
EDSL1 Double symmetrical points, left-hand (2 ft. radius) ... ... ... }

## FOR CLOCKWORK TRAINS

B1 Straight rails ... ... per doz. 3/6
A1 Curved rails ... ... ,, ,, 3/6

PR1 Right-hand points (1 ft. radius) ... ... ... } per pair 3/-
PL1 Left-hand points (1 ft. radius) ... ... ... }

PR2 Right-hand points (2 ft. radius) ... ... ... } per pair 3/-
PL2 Left-hand points (2 ft. radius) ... ... ... }

CA2 Acute-angle crossings (for 2 ft. radius track) each 1/6

PPR2 Parallel points, right-hand ... ... ... } per pair 3/6
PPL2 Parallel points, left-hand ... ... ... }
The above can be used for either 1 ft. or 2 ft. radius track.

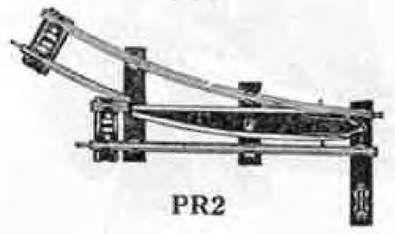
DC2 Curved rails, double track, 2 ft. radius only ... ½ doz. 6/-

**Ask your dealer for an illustrated price list.**

MECCANO LIMITED, Binns Road, Liverpool 13



B1



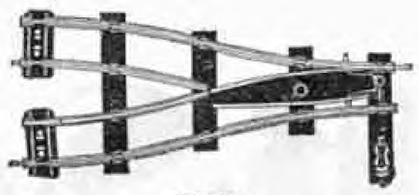
PR2



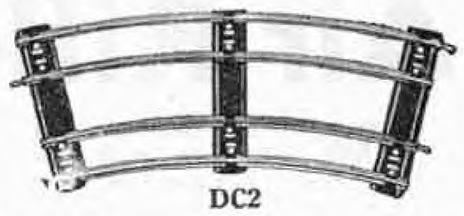
A2



CA2



PPR2



DC2

# MECCANO

ENGINEERING FOR BOYS

## The World's Finest Hobby for Boys



Every part in the Meccano system is designed with precision by technical experts.

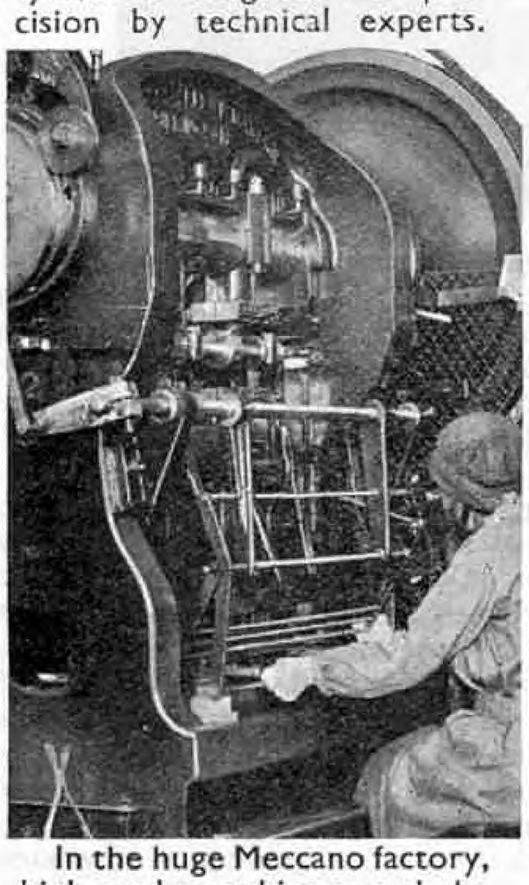
Every boy is happiest when he is inventing, creating and building. That is the reason for the everlasting popularity of Meccano. It is the most fascinating hobby in the world, because it enables full scope to be given to all the inclinations and desires that are the natural heritage of boys.

The Meccano system is composed of approximately 350 different parts, each of which serves a definite mechanical purpose. These perfectly finished parts combine to form a complete miniature engineering system with which practically any mechanical movement can be reproduced in model form.



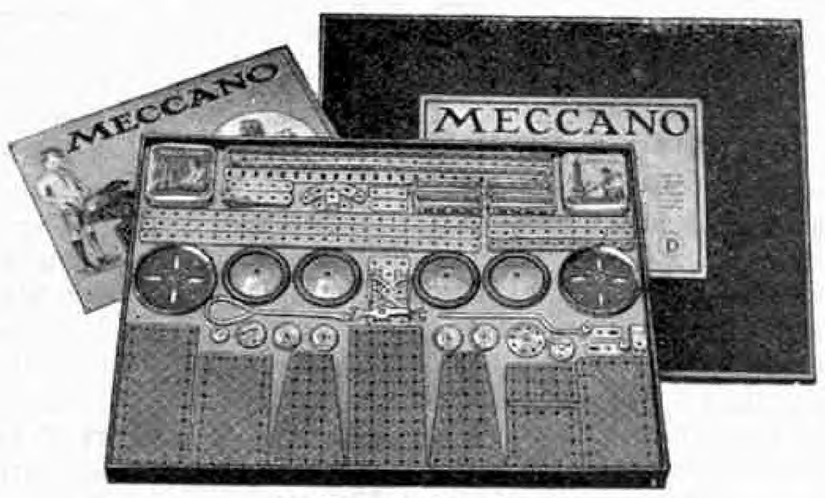

B Meccano Outfit

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In the huge Meccano factory, high-grade machinery and the best material obtainable combine to produce the world's best hobby for boys.

### PRICES OF COMPLETE MECCANO OUTFITS




D Meccano Outfit

**COMPLETE OUTFITS**

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|---|---|---|---|---|---|---|---|
| A | Outfit | each | 5/– | G | Outfit | each | 55/– |
| B | ,, | ,, | 7/6 | H | ,, (Carton) | ,, | 72/6 |
| C | ,, | ,, | 10/– | Hw | ,, (Cabinet) | ,, | 97/6 |
| D | ,, | ,, | 15/– | K | ,, (Carton) | ,, | 132/6 |
| E | ,, | ,, | 20/– | Kw | ,, (Cabinet) | ,, | 157/6 |
| F | ,, | ,, | 30/– | L | ,, ( ,, ) | ,, | 400/– |

**ACCESSORY OUTFITS**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Aa | converts A Outfit into B | | | B | each | 2/6 |
| Ba | ,, B ,, ,, C | | | C | ,, | 3/– |
| Ca | ,, C ,, ,, D | | | D | ,, | 5/6 |
| Da | ,, D ,, ,, E | | | E | ,, | 5/6 |
| Ea | ,, E ,, ,, F | | | F | ,, | 11/– |
| Fa | ,, F ,, ,, G | | | G | ,, | 26/6 |
| Ga | ,, G ,, ,, H | | | H | ,, | 17/6 |
| Ha | ,, H ,, ,, K | | | K | ,, | 60/– |
| Ka | ,, K ,, ,, L | | | L | ,, | 225/– |

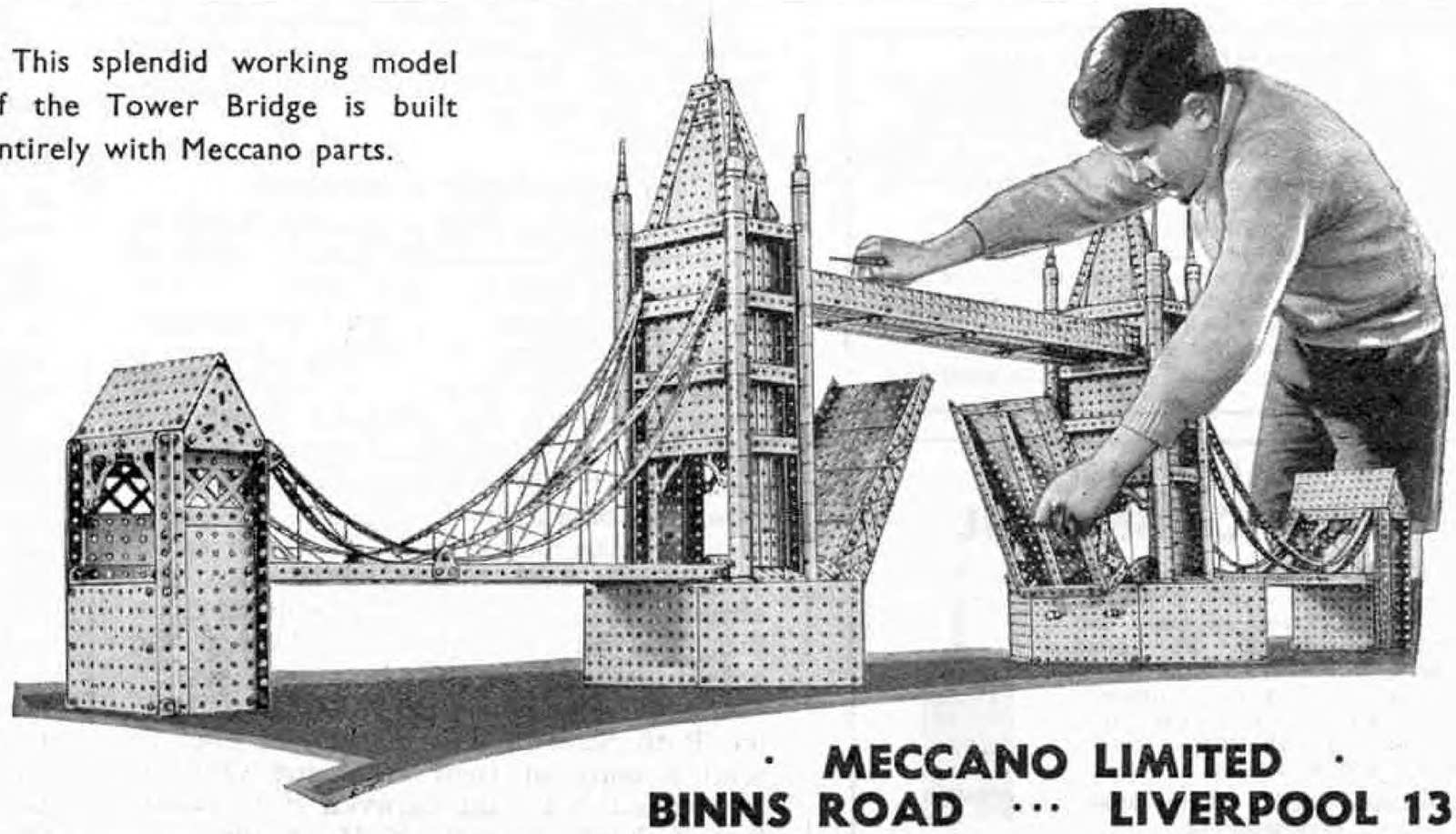
## Real Engineering in Miniature




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**The BRAMLEY STAMP Co., Town End, Bramley, Leeds.**

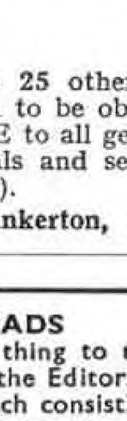
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**FREE**
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These Writing Pads are just the thing to use when writing to your friends or to the Editor.
They are supplied in two sizes, each consisting of 50 printed sheets of tinted bank paper with cover. Prices—Large, 1/- each (post free); Small, 6d. each (post free).
**ENVELOPES**
Special envelopes, attractively printed and matching the writing paper in colour, are also available. These are suitable for both the large and the small sheets of writing paper.
Price, per packet of 50, 8d. post free.
**Meccano Ltd., Binns Road, Liverpool 13**

**MECCANO LUBRICATING OIL**
Before commencing to operate a Meccano model, or to run a Hornby Train, all gears and bearings should be oiled thoroughly with Meccano Lubricating Oil. This oil is specially prepared and is of the right consistency for the purpose. Price per bottle 6d.


**Meccano Ltd., Binns Road, Liverpool 13.**

## New Cycling Accessories

The container of the well-known Chemico 6d. repair outfit has been altered so that it now conforms to modern standards. The price of the smaller repair outfit has been reduced to 3d. for the present season. The patches are self-vulcanizing.

The old trouble of slipping handle-bar grips appears to have been successfully overcome by the introduction of a new type grip. The inside of this accessory is moulded in the form of a continuous suction thread that takes firm hold of the handle-bars without the use of gum or other adhesive. Other new items of interest are fibre brake blocks and seamless valve tubing.

Our advertisers, The County Chemical Company Ltd., Chemico Works, Birmingham, 5, will be pleased to send full details of these new lines to any reader who writes mentioning the *"M.M."*

## Castrol Miniature Posters

C. C. Wakefield and Co. Ltd., the famous oil manufacturers, are offering free to readers of the *"Meccano Magazine"* perfect miniatures of their metal advertisement signs and paper posters. These are 2¼ in. long and 1½ in. wide and will be very useful to miniature railway owners and all who are interested in any way in model-building. On a miniature railway they can be used to add a final touch of realism to stations and lineside accessories, and Dinky Toys enthusiasts can use them with similar effect on garages and aerodrome buildings.

They will be sent at once to all readers who write to Wakefield House, Cheapside, London, E.C.2, and mention the *"M.M."*

## Garden Fountains

Those of our readers who are interested in gardening and have in mind the construction of a water garden, will find the new Stuart Centrifugal Pumps of special interest. Each unit consists of a pump and operating motor fitted with a novel type gland that prevents leakage without power wastage.

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Full details of these pumps can be obtained by any reader direct from Stuart Turner Ltd., Henley-on-Thames, on mentioning the *"M.M."*

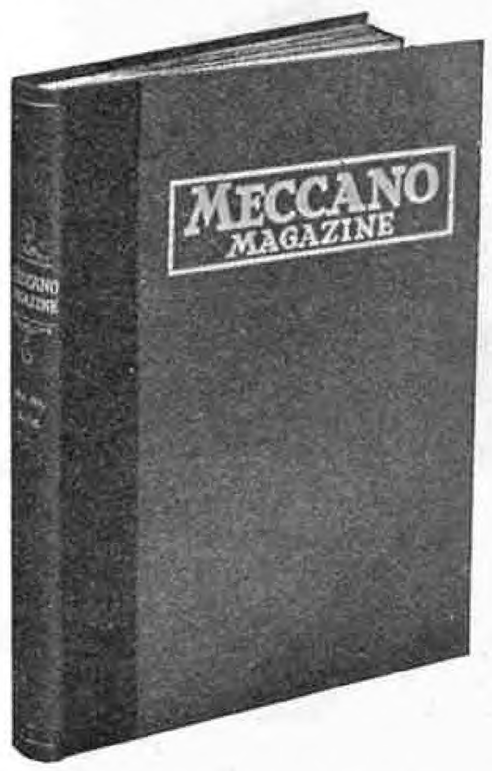
## Home-built Caravans

Motor cruising with a caravan trailer is becoming an increasingly popular form of holiday in Britain, and many of our readers doubtless have given some thought to the possibility of building their own caravan trailers. They will be interested to know, therefore, that Holland Coachcraft Ltd., have recently placed on the market Home Construction Caravan Kits, complete from the blueprints to the number plate, at most reasonable prices. All the troublesome work with hinges, glass, etc., has already been carried out in producing these kits, and any handyman would find the actual assembly a simple matter.

Our advertisers, Holland Coachcraft Ltd., 95, Bath Street, Glasgow, will be glad to send a copy of their catalogue of Constructional Kits and Caravan Equipment, free of charge, to any *"M.M."* reader.

# Binding the "M.M."

There are two methods of binding the *"M.M."* to preserve back copies from the mutilation that inevitably will be theirs should they be handled for any lengthy period without protection. First there is the spring-back binder system, that permits the copies to be inserted or removed from the binding case at will. This is intended primarily as a temporary arrangement for the protection of copies during the currency of their volume.




Handsome spring-back cases specially prepared for the *"M.M."*, with the name blocked in gold letters on the front cover, can be obtained from Meccano Limited, Binns Road, Liverpool 13, price 2/6 and 3/6 for sizes large enough to hold 6 and 12 copies of current issues respectively.

Permanent binding cases for back numbers of the Magazine can be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases are supplied in two sizes (1) for six copies, price 3/3 and (2) for twelve copies, price 4/9, post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown above. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

## Binding Six or Twelve Copies

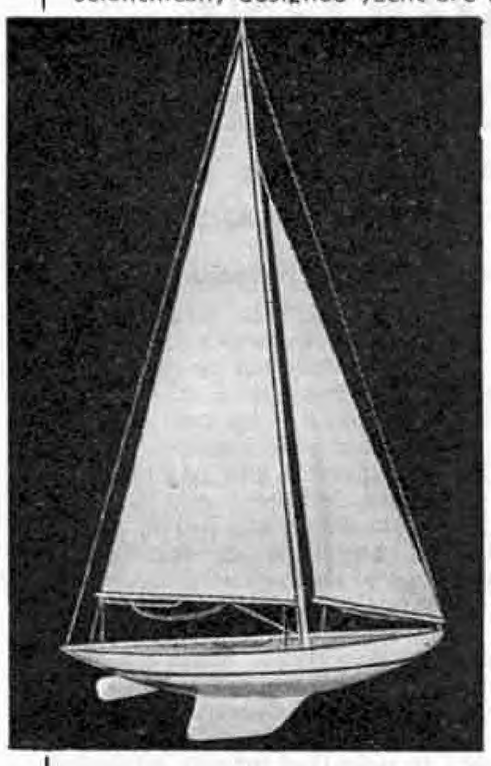
These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 5/9 for six issues or 7/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., carriage paid.

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Plated Fittings

**Racing Yachts**

| | | | |
|---|---|---|---|
| No. 1 | 18″ long | (without steering gear) ... | 21/– |
| ,, 2 | 22″ ,, | (with auto-steering gear) | 32/6 |
| ,, 3 | 26″ ,, | ,, ,, ,, ,, | 45/– |
| ,, 4 | 30″ ,, | ,, ,, ,, ,, | 84/– |
| ,, 5 | 36″ ,, | ,, ,, ,, ,, | 126/– |
| ,, 4 | 42″ ,, | ,, ,, ,, ,, | 177/6 |

# LUCAS'S

The Boys' Arcadia,

**17, Houghton St., Clayton Sq., Liverpool, 1.**

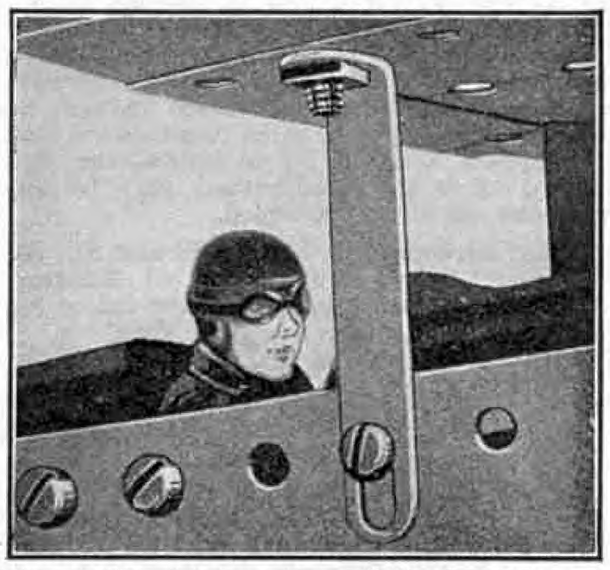
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Part No. P100 (illustrated above) is used in Nos. 1, 2, 1 Special and 2 Special Outfit models. The Pilot is fixed to a double angle bracket ready for bolting to the sides of the fuselage.

Prices:

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|---|---|---|---|
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| P100 | ,, ,, | ... ... | ,, 4d. |

**Meccano Ltd., Binns Road, Liverpool 13**

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Special—8X Prism Binoculars (to-day's value £5/5/–) 59/6. (*Est. 1913*)

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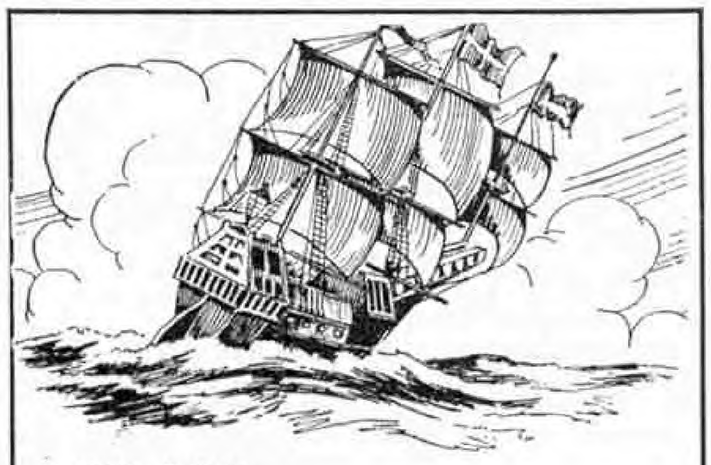
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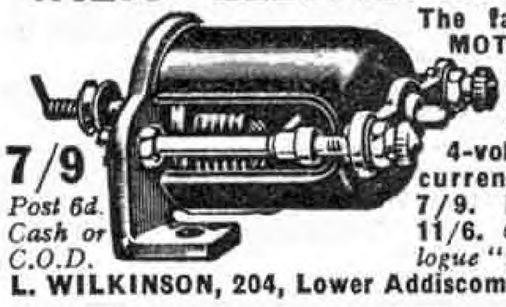
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*Meccano Magazine, Binns Road,*
Liverpool 13.


# MECCANO MAGAZINE

*Registered at G.P.O., London, for transmission by Canadian Magazine Post.*

**EDITORIAL AND ADVERTISING OFFICE:—**
LIVERPOOL 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

**Publication Date.** The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

**To Contributors.** The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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**Display.** Quotations for space bookings, and latest net sale figures, will be sent on request.

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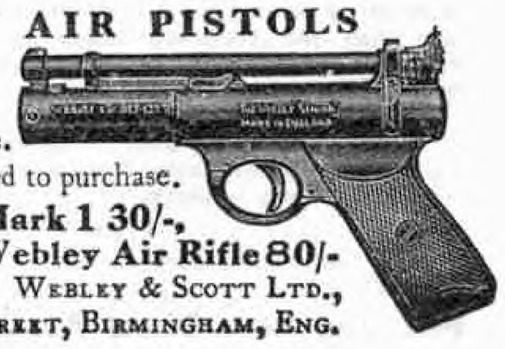
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AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Limited, Third Floor, Paykel's Buildings, 9, Anzac Avenue (P.O. Box 129), Auckland, C.1
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
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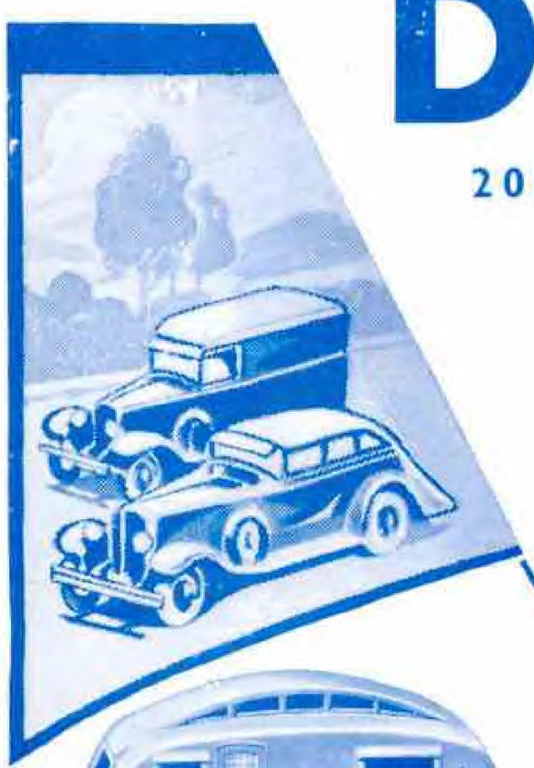

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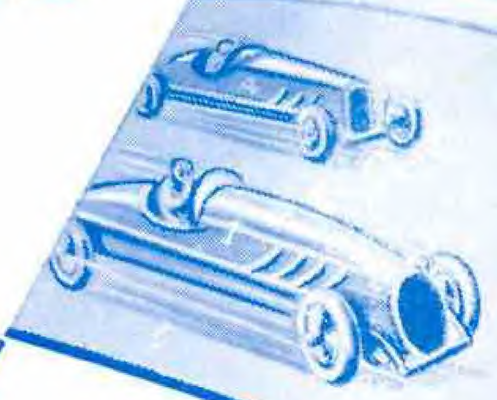





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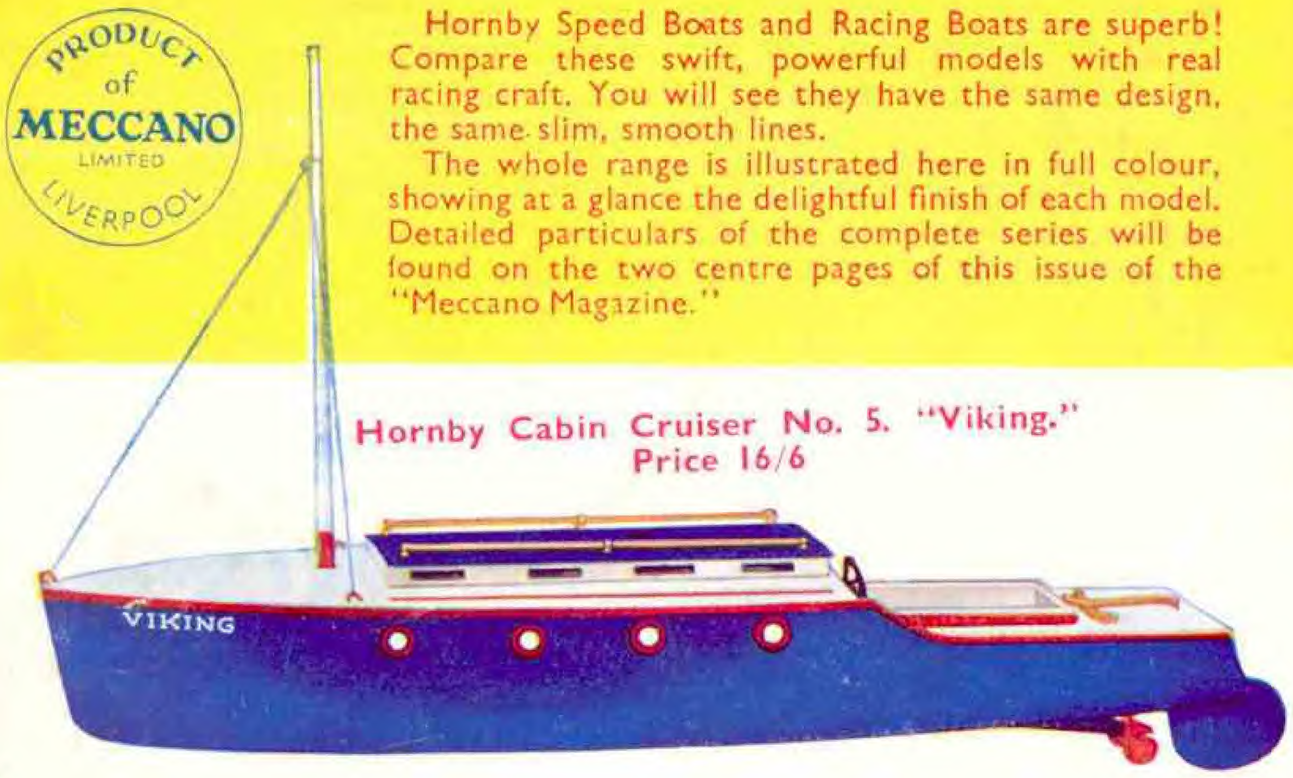
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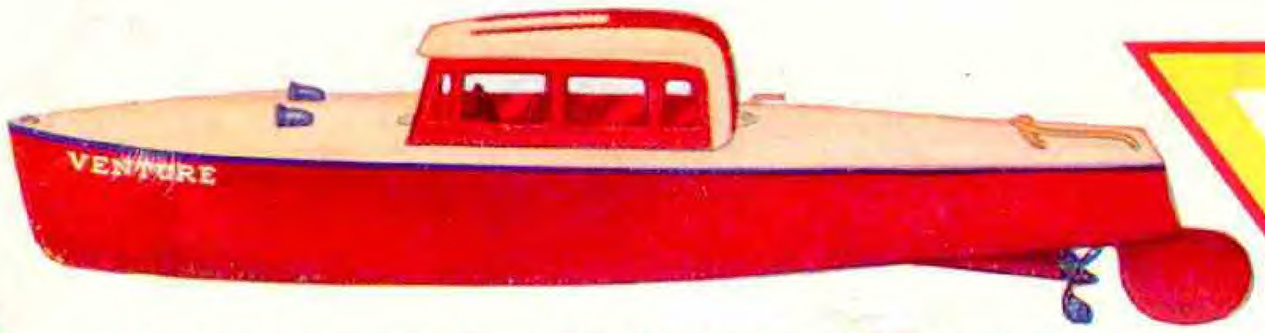
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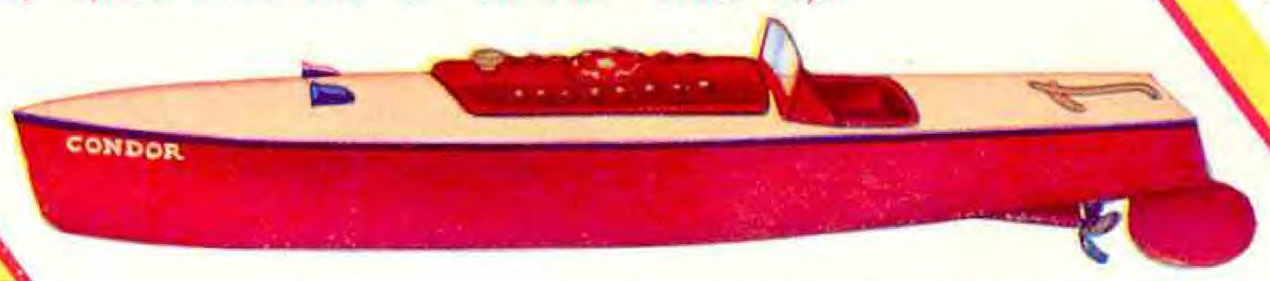

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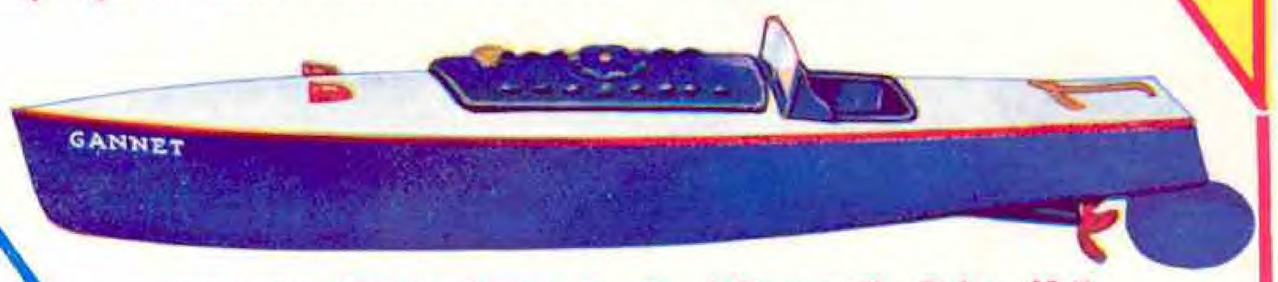

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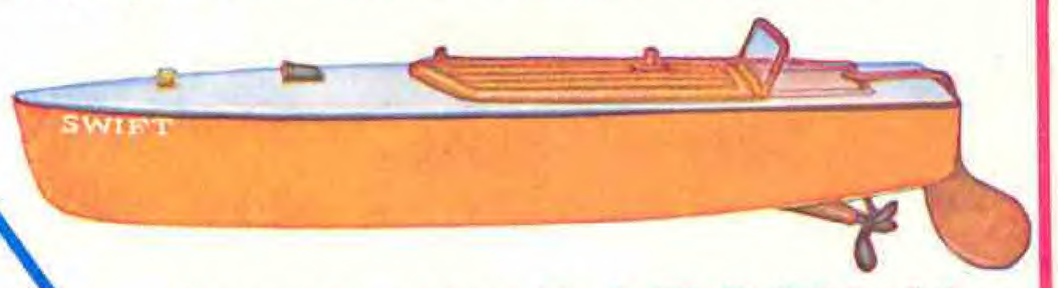

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Hornby Speed Boat No. 2. "Swift." Price 7/6



Hornby Speed Boat No. 1. "Hawk." Price 2/11

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HORNBY

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